From: Mae Empleo <mae@semlawyers.com>
Sent: Tuesday, July 29, 2014 6:12 PM
To: BDCP.comments@noaa.gov
Cc: Osha Meserve; 'Patrick M. Soluri'; warren@boglewinery.com
Subject: Bogle Vineyards' Comments on Draft BDCP and Associated Draft EIR/EIS
Attachments: Bogle Vineyards BDCP Cmnt Ltr 07.29.14.pdf

Dear Mr. Wulff:

Attached please find the comment letter submitted on behalf of Bogle Vineyards regarding the Draft BDCP and Associated Draft EIR/EIS. Should you have questions, please do not hesitate to contact our office.

Sincerely,

Mae Ryan Empleo
Legal Assistant
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SOLURI MESERVE
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BDCP 1751

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July 29, 2014

SENT VIA EMAIL (BDCP.comments@noaa.gov)

Mr. Ryan Wulff
National Marine Fisheries Service
650 Capitol Mall, Suite 5-100
Sacramento, CA 95814

RE: Comments on Draft Bay Delta Conservation Plan and Associated Draft Environmental Impact Report/Environmental Impact Statement

Dear Mr. Wulff:

This letter is submitted on behalf of Bogle Vineyards ("Bogle"). Bogle, located in Clarksburg, California, is within the area represented by Local Agencies of the North Delta ("LAND"), and accordingly incorporates by reference LANDS's extensive comments on the BDCP and its EIR/EIS that are separately transmitted. However, the BDCP's potentially devastating implications for the Delta and its communities, economy and environment have compelled Bogle to also indicate its individual opposition to the BDCP.

Instead of helping to restore the Delta, the BDCP is a massive water removal project with potential to cause more ecological harm to the Delta than anything else that has occurred since the last large infrastructure was built by the state and federal water projects. The BDCP fails to reduce reliance on water from the Delta and will instead create fictional water supplies to justify taking more water than the state and federal water projects have historically exported. As a result, this will devastate the unique cultural, recreational, natural resource, and agricultural values of the Delta.

The fundamental ecological premise of the BDCP is fatally flawed. The BDCP presupposes that removing nearly half of high quality freshwater from the Sacramento River system will be a net benefit for listed aquatic species while losing up to 5 percent of the remaining Sacramento River salmonids as they attempt to run approximately 4,400 feet of almost consecutive intake screens in just three river miles. All the while, BDCP refuses to build effective fish barriers on the South Delta pumps, which will still operate much of the time.

BDCP 1751

Improving the Delta's ecology cannot possibly happen by removing even more water from the system. Yet, the BDCP proposes to take as much water as possible and hope that a future "habitat" fix will keep it all working. However, the scientific basis for the habitat is thin at best and is far likelier to improve conditions for the very invasive species that currently harm the Delta. In order to retain their 50-year permit in the face of likely ecological failures, the BDCP simply states that meeting biological goals and objectives is not a requirement of the project. To mitigate for its own, new biological impacts, the BDCP says it will build some habitat, somewhere, to be analyzed at some future point in some future document. That new habitat comes at a cost to the exiting, already imperiled, habitat of the Delta, mainly by trading off one set of listed terrestrial species for aquatic species.

All the while local landowners are forced to sell or have their land condemned. Multi-generational farming families will be challenged to continue farming in what is presently an ideal agricultural region containing 738,000 acres of prime farmland. Even if a few landowners manage to remain in the Delta, they will be adjacent to major land and water use changes that will completely alter existing conditions for the worse. The discussion of the BDCP's impacts on agricultural resources in the EIR/EIS is inadequate. The character and magnitude of the impact of the project on agricultural resources is not disclosed.

Unfortunately, the vast majority of issues significantly affecting in-Delta interests have been ignored or affirmatively swept under the rug. A positive outcome for everyone requires a true collaborative approach and attention to protection of in-Delta values, but has not yet occurred. The BDCP, after years of development, still does not present a project that would be acceptable to Delta communities.

Very truly yours,

SOLURI MESERVE
A Law Corporation

By: Patrick M. Soluri

PMS/mre

cc: Warren Bogle (warren@boglewinery.com)

From: Floyd Cranmore <fwcranmore@yahoo.com>
Sent: Tuesday, July 29, 2014 7:53 PM
To: BDCP.comments@noaa.gov; 1 FW Floyd Cranmore; F
Subject: Comments to BDCP draft EIR
Attachments: IPCC_WG2AR5_SPM_Approved.pdf; BDCP EIR Comments.doc

Attachments
1) comments to BDCP in Word;
2) Article "Climate Change 2014: Impacts, Adaptation, and Vulnerability

BDCP 1752

Econ - search Paulson and crazy report and 6-24-14

Comment re BDCP initial EIR, etc.:

Summary: Current reliable, hard data show the risks of a rise in gross mean sea level are starkly higher, my meters, than those assumed in the data relied upon for the draft EIR. The risks of a catastrophic rise are substantially higher than assumed, even within the 60 year initial permit period, and move from very high risk to scientific certainty for the multi-permit period lifetime of the BDCP. This rise level effectively moots the BDCP from multiple standpoints. These range from basic engineering and salinity precepts to broader issues of trying to avoid a significant portion of the Central Valley being submersed under high-saline brackish or ocean waters. This realization by Central Valley residents, agri-business, and real estate interests are likely to spur a shift in resources to what will be almost certainly be "last minute efforts" to try a massive infrastructure construction project to prevent the Central Valley from again becoming an inland ocean.

According to a NASA article of Jan. 21, 2014, " Long-Term Climate Warming Trend Sunstained in 2013", NASA measurements show the earth has been getting hotter:

> NASA scientists say 2013 tied with 2009 and 2006 for the seventh warmest year since 1880, continuing a long-term trend of rising global temperatures. With the exception of 1998, the 10 warmest years in the 134-year record all have occurred since 2000, with 2010 and 2005 ranking as the warmest years on record.
>
> NASA's Goddard Institute for Space Studies (GISS) in New York, which analyzes global surface temperatures on an ongoing basis, released an updated report Tuesday on temperatures around the globe in 2013. The comparison shows how Earth continues to experience temperatures warmer than those measured several decades ago.
>
> "Long-term trends in surface temperatures are unusual and 2013 adds to the evidence for ongoing climate change," GISS climatologist Gavin Schmidt said. "While one year or one season can be affected by random weather events, this analysis shows the necessity for continued, long-term monitoring."

<http://science.nasa.gov/science-news/science-at-nasa/2014/21jan_2013/>

The BDCP EIR released in 2014 relied on Global Warming and sea level rise data from 2007. Such date is basically, ancient history in the context of Global Warming and sea level rise research. Use of such grossly out of date data is the only way the BDCP EIR could ever have gone forward politically, scientifically, or otherwise. Had staff been allowed by political decision makers to use current data, it would have demonstrated conclusively, based on sound scientific data, that the BDCP is fundamentally impossible.

However, such gamesmanship with the data has allowed policy makers to claim they are making progress on the topic, thereby allowing them to continue garnering huge campaign donations from well-heeled real estate developers, particularly from water hungry Southern California region. (Should the public realize how much they have been effectively "bamboozled" by policy makers on this, it may, ironically, be the one impetus that might actually be able to propel the current initiative to "split up" California into multiple states.)

This year (2014) saw numerous new scientifically valid reports and data on global warming and climate change and attendant ice pack melting causing gross mean sea level rise. More realistic sea level rise predictions from both national and international sources suggest BDCP assumptions are too conservative by meters and by decades. Such data and reports also are now beginning to show that the ice pack melting driving the rise in gross mean sea level is now "irreversible". Thus, the issue is no longer one of "what if" but when and how much.

One report in particular, regarding the now irreversible decay in just the Western Antarctica Ice Sheet, maps out the global 10 ft rise expected by 2010, just from that ice sheet ALONE. Just that one sea level rise source, alone, will not only cause inundation of large swaths (basically all) of the natural habitat areas addressed in the BDCP EIR, but it will also basically inundate large swaths of the Central Valley, covering up to one-half of the Cities of Stockton and Elk Grove. Other areas, such as Woodbridge, Fairfield, and Land Park in Sacramento would basically become new "beachfront properties" (or "marsh front properties"), absent unprecedented infrastructure development. Not only will many of the Delta habitat areas and even "Agri-Islands" be lost, but also even massive chunks of the Central Valley, arable, non-island, land now used for Agri-business interests, as well. See e.g.:
http://science.nasa.gov/science-news/science-at-nasa/2014/12may_noturningback/
See websites re economic impacts, e.g.:
http://www.businessinsider.com/west-antarctic-ice-sheet-collapse-means-2014-5
http://www.washingtonpost.com/business/economy/former-treasury-secretaries-financial-leaders-press-business-to-cut-climate-change-risks/2014/06/23/72c88274-fb15-11e3-8176-f2c941cf35f1_story.html
See also websites further below.

And the Eastern Antarctic Ice Sheet is also at significant risk:
http://news.yahoo.com/east-antarctica-more-risk-thought-long-term-thaw-171024477.html

And NASA reports show the Artic Ice Pack melt season is lengthening, e.g.:
http://science.nasa.gov/science-news/science-at-nasa/2014/01apr_arcticice/

While there are possibilities to use that huge salt water intrusion/expansion to create huge salt water marsh habitat areas, the state Agri-business and Real Estate interests will demand, and (given their political donations/clout) quite likely receive, huge cement sea wall super-levies all around their existing "islands", and soon-to-be "islands"

in an areas stretching Eastward basically to Hwy 99 across swaths of the Central Valley.

Such massive cement super-levies will be one of the very few remaining options available, since the gross mean sea water level rise will be so high as to overtop the existing earthen levy system. And such earthen levy system would become structurally unsound long before being overtopped -- from water pressure to natural wave action, much less the risks of liquefaction during a serious seismic event.

.

The air pollution impacts of the massive construction for the cement super-levies alone would far outpace anything set out I the BDCP EIR (and the Bullet Train combined).

The basic functionality of the BDCP will be utterly mooted, anyway, because the entire currently extant Delta area and anticipated BDCP complex substantially submersed under brackish or salt water anyway.

I have personally interviewed geologists at Sac State, who, privately, are also quite worried about the risks of a another, independent, and even greater source of sea level rise -- the rapid melt, then "slide off" of the Greenland glacial ice sheets, (i.e., in addition to those in Antarctica, above), etc. Under current scientifically valid estimates (including based on geological evidence of such a past event), the addition to the Greenland ice sheet waters to the world oceans is estimated to independently cause a far more massive gross mean sea level rise, up to 20 ft, and on a vastly faster time scale, given the past geologic record showing that exactly this scenario has happened in the past and will occur again. See the book "Flooded Earth" by Prof. Peter Ward < http://www.worldpreservationfoundation.org/blog/news/biologist-warns-of-danger-from-rising-sea-levels/#.U6oEmrGM7qw>

Prof. Ward raises the geological historical fact that when the Greenland ice sheet starts melting, and moving -- due to sub-glacial lubrication from melt water at the bottom of the ice at the ice/land interface, the increased glacial movement in turn increase friction, causing even more melting, proving more water at the interface, causing more movement, etc., in a cyclic, cascading effect. The net result is that, from a historical geological perspective, the Greenland ice sheet tends to just slide off the land mass, en mass, very precipitously, causing tidal waves and very rapid sea level rise on an unprecedented scale. (Such an event would wipe out more people, cities, and wealth than a full scale nuclear war. Countries such as Bangladesh will basically cease to exist.) See e.g.:
http://finance.yahoo.com/news/flooded-british-villages-ignite-climate-debate-144050840--finance.html

The combined risk of just the 20 ft. rise from the Greenland Ice Sheet melt and rapid "slide off" PLUS the now irreversible 10 ft rise from an Antarctic sheet, means an anticipated gross mean sea level rise of 30 ft, with a substantial part of that at risk

during the first 60 year permit period for the BDCP. Large swaths of the Central Valley are less than 30 ft above current sea level.

This means massive, wholesale, unavoidable environmental impacts and disruptions on a massive -- extinction-event type scale -- dwarfing the environmental concerns otherwise admirably expressed in the BDCP EIR. See, e.g., Article on Arrival of 6th Earth Mass Extinction at Science Daily: http://www.sciencedaily.com/releases/2014/07/140724171956.htm

However, NO ONE connected to BDCP seems to even be talking about these rather dire outcomes based on established science.

The Sac. State geologists independently mirrored others' concerns that the only way to stop the inundation of the Central Valley from the coming, unavoidable, massive gross mean sea level rise and salt water intrusion would be some type of massive, Three-Gorges-Dam-equivalent across the inner Bay/Delta area. Such a massive public works project (with massive environmental devastation of all kinds and massive costs dwarfing the BDCP and Bullet Train combined) would necessarily create a fresh water "ocean" out of much of the Central Valley, backing up behind it well into the far reaches of the Central Valley, as opposed to allowing it to become a brackish or salt water inland ocean. However, given the massive human-scape infrastructure of the East Bay, Sacramento, etc., prompt immediate massive environmental clean-up would be required to render the new Central Valley fresh water sea to be useable.

Just to recap, even the massive "dam" scenario will not, and cannot, stop the eventual, and inevitable, inundation of the Central Valley. It will just change the inundation it from salt to fresh water. Either way will cause massive environmental, economic, Agri-business, Real Estate, and other significant disruptions.

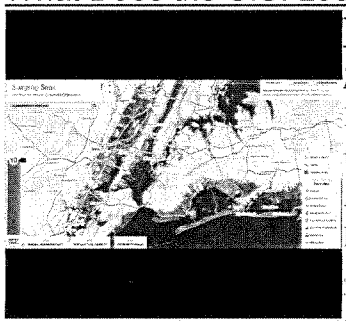
Below are links to the general study, and to its map of the Stockton/Delta area reflecting the 10 ft rise that will now occur based solely on the West Antarctic glacial cap ice melt, etc. Others are readily available, if the decision makers will but stop hamstringing scientific staff with the inane bar to using "current", real-time, valid scientific data and reports.

I regret to be the bearer of such unfavorable tidings. And as with the Climate Change deniers generally, it is doubtful that the big money interests behind the BDCP will allow bothersome little problems like the valid science behind of gross mean sea level rise to slow down their push for the BDCP. Which means natural habitat areas will be placed literally between the proverbial rock and a hard place (or rather, the coming cement super-levies and the massive sea level rise and salt water intrusion, or else the Straits Dam type scenario).

It seems public knowledge now that most of the Climate Change denier "scientific report backup" was funded by Exxon, basically as a negotiation tactic, until it managed to land the bulk of the oil exploration rights across the Arctic Circle. [It seems Exxon is

already planning on the coming major melting wrought by Global Warming throughout the Arctic region in their long range plans and forecasts, so as to allow them to place Gulf of Mexico type oil rigs all the way up to the North Pole in the not too distant future.] Now they have their future oil exploration rights locked up, Exxon has now reversed course and acknowledged the fact of Global Warming and sea level rise, and is asking policy makers to do something about it.

SEE WEBSITES
http://www.scientificamerican.com/article/what-does-the-u-s-look-like-after-3-meters-of-sea-level-rise/
What Does the U.S. Look Like after 3 Meters of Sea Level Rise?



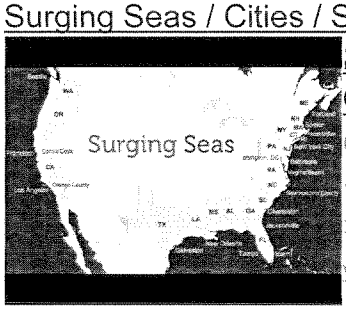
What Does the U.S. Look Like after 3 Meters of Sea Level...

New research indicates that climate change has triggered an unstoppable decay of the West Antarctic Ice Sheet, eventually leading to at least three mete...

View on www.scientificameric...

Preview by Yahoo

http://sealevel.climatecentral.org/surgingseas/place/cities/CA/Stockton#show=cities&center=8/37.963/-121.302&surge=10
Surging Seas / Cities / Stockton, California



Surging Seas / Cities / Stockton, California

Over 1 in 6 chance sea level rise + storm surge + tide will overtop +1ft by ??? at nearest flood risk indicator site; , miles away.

View on sealevel.climatecentr...

Preview by Yahoo

I would prefer to have been able to comment on the many ways to help to preserve natural wildlife and plant habitats such as the Cosumnes River Preserve off Hwy I-5 South of Sacramento, just to name one prime example.

However, that preserve, and basically all the currently extent Delta are already unavoidably doomed by the effects of Global Warming and gross mean sea level rise.

The BDCP, as currently planned, is now a mooted "boondoggle", on a far grander scale than any "Bridge to Nowhere". Indeed, it is now worse than useless, as it only serves to distract us by "fiddling while Rome burns" (or rather dithering while the Central Valley floods). It may be intended by large Ag and Real Estate interests as a "warm up" for the massive and sweeping environmental engineering that will be demanded once the general population realizes the true dangers to come (not just risks

that "might" come) from Global Warming and gross mean sea level rise on a massive and unprecedented scale.

Yours,
Floyd Cranmore
510 Kirst Dr.
Woodbridge, CA 95258
fwcrannmore@hotmail.com

PS Please also Note: There are numerous additional factors in the rapid advance of global warming, and thus gross mean sea level rise. These range from use of "fracking" techniques which inject super-hot-house gasses such as methane into the atmosphere, to the thawing of the Arctic permafrost, which holds an estimated one-fourth (25%) of the carbon dioxide on Earth. See, e.g.:
http://www.canada.com/technology/Mysterious+giant+crater+earth+discovered+Siberia+World/10035027/story.html

Climate Change 2014: Impacts, Adaptation, and Vulnerability

SUMMARY FOR POLICYMAKERS

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CONTENTS OF THE SUMMARY FOR POLICYMAKERS

ASSESSING AND MANAGING THE RISKS OF CLIMATE CHANGE

Human interference with the climate system is occurring,[1] and climate change poses risks for human and natural systems (Figure SPM.1). The assessment of impacts, adaptation, and vulnerability in the Working Group II contribution to the IPCC's Fifth Assessment Report (WGII AR5) evaluates how patterns of risks and potential benefits are shifting due to climate change. It considers how impacts and risks related to climate change can be reduced and managed through adaptation and mitigation. The report assesses needs, options, opportunities, constraints, resilience, limits, and other aspects associated with adaptation.

Climate change involves complex interactions and changing likelihoods of diverse impacts. A focus on risk, which is new in this report, supports decision-making in the context of climate change, and complements other elements of the report. People and societies may perceive or rank risks and potential benefits differently, given diverse values and goals.

Compared to past WGII reports, the WGII AR5 assesses a substantially larger knowledge base of relevant scientific, technical, and socioeconomic literature. Increased literature has facilitated comprehensive assessment across a broader set of topics and sectors, with expanded coverage of human systems, adaptation, and the ocean. See Background Box SPM.1.[2]

Section A of this summary characterizes observed impacts, vulnerability and exposure, and adaptive responses to date. Section B examines future risks and potential benefits. Section C considers principles for effective adaptation and the broader interactions among adaptation, mitigation, and sustainable development. Background Box SPM.2 defines central concepts, and Background Box SPM.3 introduces terms used to convey the degree of certainty in key findings. Chapter references in brackets and in footnotes indicate support for findings, figures, and tables.

Figure SPM.1: Illustration of the core concepts of the WGII AR5. Risk of climate-related impacts results from the interaction of climate-related hazards (including hazardous events and trends) with the vulnerability and exposure of human and natural systems. Changes in both the climate system (left) and socioeconomic processes including adaptation and mitigation (right) are drivers of hazards, exposure, and vulnerability. [19.2, Figure 19-1]

Background Box SPM.1. Context for the Assessment

For the past two decades, IPCC's Working Group II has developed assessments of climate-change impacts, adaptation, and vulnerability. The WGII AR5 builds from the WGII contribution to the IPCC's Fourth Assessment Report (WGII AR4), published in 2007, and the Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX), published in 2012. It follows the Working Group I contribution to the AR5 (WGI AR5).[3]

[1] A key finding of the WGI AR5 is, "It is *extremely likely* that human influence has been the dominant cause of the observed warming since the mid-20th century." [WGI AR5 SPM Section D.3, 2.2, 6.3, 10.3-6, 10.9]
[2] 1.1, Figure 1-1
[3] 1.2-3

The number of scientific publications available for assessing climate-change impacts, adaptation, and vulnerability more than doubled between 2005 and 2010, with especially rapid increases in publications related to adaptation. Authorship of climate-change publications from developing countries has increased, although it still represents a small fraction of the total.[4]

The WGII AR5 is presented in two parts (Part A: Global and Sectoral Aspects, and Part B: Regional Aspects), reflecting the expanded literature basis and multidisciplinary approach, increased focus on societal impacts and responses, and continued regionally comprehensive coverage.

Background Box SPM.2. Terms Central for Understanding the Summary[5]

Climate change: Climate change refers to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings such as modulations of the solar cycles, volcanic eruptions, and persistent anthropogenic changes in the composition of the atmosphere or in land use. Note that the Framework Convention on Climate Change (UNFCCC), in its Article 1, defines climate change as: 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.' The UNFCCC thus makes a distinction between climate change attributable to human activities altering the atmospheric composition, and climate variability attributable to natural causes.

Hazard: The potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources. In this report, the term *hazard* usually refers to climate-related physical events or trends or their physical impacts.

Exposure: The presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected.

Vulnerability: The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt.

Impacts: Effects on natural and human systems. In this report, the term *impacts* is used primarily to refer to the effects on natural and human systems of extreme weather and climate events and of climate change. Impacts generally refer to effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services, and infrastructure due to the interaction of climate changes or hazardous climate events occurring within a specific time period and the

[4] 1.1, Figure 1-1
[5] The WGII AR5 glossary defines many terms used across chapters of the report. Reflecting progress in science, some definitions differ in breadth and focus from the definitions used in the AR4 and other IPCC reports.

vulnerability of an exposed society or system. Impacts are also referred to as *consequences* and *outcomes*. The impacts of climate change on geophysical systems, including floods, droughts, and sea-level rise, are a subset of impacts called physical impacts.

Risk: The potential for consequences where something of value is at stake and where the outcome is uncertain, recognizing the diversity of values. Risk is often represented as probability of occurrence of hazardous events or trends multiplied by the impacts if these events or trends occur. Risk results from the interaction of vulnerability, exposure, and hazard (see Figure SPM.1). In this report, the term *risk* is used primarily to refer to the risks of climate-change impacts.

Adaptation: The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects.

Transformation: A change in the fundamental attributes of natural and human systems. Within this summary, transformation could reflect strengthened, altered, or aligned paradigms, goals, or values towards promoting adaptation for sustainable development, including poverty reduction.

Resilience: The capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation.

Background Box SPM.3. Communication of the Degree of Certainty in Assessment Findings[6]

The degree of certainty in each key finding of the assessment is based on the type, amount, quality, and consistency of evidence (e.g., data, mechanistic understanding, theory, models, expert judgment) and the degree of agreement. The summary terms to describe evidence are: *limited*, *medium*, or *robust*; and agreement: *low*, *medium*, or *high*.

Confidence in the validity of a finding synthesizes the evaluation of evidence and agreement. Levels of confidence include five qualifiers: *very low*, *low*, *medium*, *high*, and *very high*.

The likelihood, or probability, of some well-defined outcome having occurred or occurring in the future can be described quantitatively through the following terms: v*irtually certain,* 99–100% probability; *extremely likely,* 95– 100%; *very likely,* 90–100%; *likely,* 66–100%; *more likely than not,* >50–100%; *about as likely as not,* 33–66%; *unlikely,* 0–33%; *very unlikely,* 0–10%; *extremely unlikely,* 0–5%; and *exceptionally unlikely,* 0–1%. Unless otherwise indicated, findings assigned a likelihood term are associated with *high* or *very high* confidence. Where appropriate, findings are also formulated as statements of fact without using uncertainty qualifiers.

[6] 1.1, Box 1-1

Within paragraphs of this summary, the confidence, evidence, and agreement terms given for a bold key finding apply to subsequent statements in the paragraph, unless additional terms are provided.

A) OBSERVED IMPACTS, VULNERABILITY, AND ADAPTATION IN A COMPLEX AND CHANGING WORLD

A-1. Observed Impacts, Vulnerability, and Exposure

In recent decades, changes in climate have caused impacts on natural and human systems on all continents and across the oceans. Evidence of climate-change impacts is strongest and most comprehensive for natural systems. Some impacts on human systems have also been attributed[7] to climate change, with a major or minor contribution of climate change distinguishable from other influences. See Figure SPM.2. Attribution of observed impacts in the WGII AR5 generally links responses of natural and human systems to observed climate change, regardless of its cause.[8]

Figure SPM.2: Widespread impacts in a changing world. (A) Global patterns of impacts in recent decades attributed to climate change, based on studies since the AR4. Impacts are shown at a range of geographic scales. Symbols indicate categories of attributed impacts, the relative contribution of climate change (major or minor) to the observed impact, and confidence in attribution. See supplementary Table SPM.A1 for descriptions of the impacts (B) Average rates of change in distribution (km per decade) for marine taxonomic groups based on observations over 1900-2010. Positive distribution changes are consistent with warming (moving into previously cooler waters, generally poleward). The number of responses analyzed is given within parentheses for each category. (C) Summary of estimated impacts of observed climate changes on yields over 1960-2013 for four major crops in temperate and tropical regions, with the number of data points analyzed given within parentheses for each category. [Figures 7-2, 18-3, and MB-2]

In many regions, changing precipitation or melting snow and ice are altering hydrological systems, affecting water resources in terms of quantity and quality (*medium confidence*). Glaciers continue to shrink almost worldwide due to climate change (*high confidence*), affecting runoff and water resources downstream (*medium confidence*). Climate change is causing permafrost warming and thawing in high-latitude regions and in high-elevation regions (*high confidence*).[9]

Many terrestrial, freshwater, and marine species have shifted their geographic ranges, seasonal activities, migration patterns, abundances, and species interactions in response to ongoing climate change (*high confidence*). See Figure SPM.2B. While only a few recent species extinctions have been attributed as yet to climate change (*high confidence*), natural

[7] The term attribution is used differently in WGI and WGII. Attribution in WGII considers the links between impacts on natural and human systems and observed climate change, regardless of its cause. By comparison, attribution in WGI quantifies the links between observed climate change and human activity, as well as other external climate drivers.
[8] 18.1, 18.3-6
[9] 3.2, 4.3, 18.3, 18.5, 24.4, 26.2, 28.2, Tables 3-1 and 25-1, Figures 18-2 and 26-1

global climate change at rates slower than current anthropogenic climate change caused significant ecosystem shifts and species extinctions during the past millions of years (*high confidence*).[10]

Based on many studies covering a wide range of regions and crops, negative impacts of climate change on crop yields have been more common than positive impacts (*high confidence*). The smaller number of studies showing positive impacts relate mainly to high-latitude regions, though it is not yet clear whether the balance of impacts has been negative or positive in these regions (*high confidence*). Climate change has negatively affected wheat and maize yields for many regions and in the global aggregate (*medium confidence*). Effects on rice and soybean yield have been smaller in major production regions and globally, with a median change of zero across all available data, which are fewer for soy compared to the other crops. Observed impacts relate mainly to production aspects of food security rather than access or other components of food security. See Figure SPM.2C. Since AR4, several periods of rapid food and cereal price increases following climate extremes in key producing regions indicate a sensitivity of current markets to climate extremes among other factors (*medium confidence*). [11]

At present the world-wide burden of human ill-health from climate change is relatively small compared with effects of other stressors and is not well quantified. However, there has been increased heat-related mortality and decreased cold-related mortality in some regions as a result of warming (*medium confidence*). Local changes in temperature and rainfall have altered the distribution of some water-borne illnesses and disease vectors (*medium confidence*).[12]

Differences in vulnerability and exposure arise from non-climatic factors and from multidimensional inequalities often produced by uneven development processes (*very high confidence*). These differences shape differential risks from climate change. See Figure SPM.1. People who are socially, economically, culturally, politically, institutionally, or otherwise marginalized are especially vulnerable to climate change and also to some adaptation and mitigation responses (*medium evidence, high agreement*). This heightened vulnerability is rarely due to a single cause. Rather, it is the product of intersecting social processes that result in inequalities in socioeconomic status and income, as well as in exposure. Such social processes include, for example, discrimination on the basis of gender, class, ethnicity, age, and (dis)ability.[13]

Impacts from recent climate-related extremes, such as heat waves, droughts, floods, cyclones, and wildfires, reveal significant vulnerability and exposure of some ecosystems and many human systems to current climate variability (*very high confidence*). Impacts of such climate-related extremes include alteration of ecosystems, disruption of food production and water supply, damage to infrastructure and settlements, morbidity and mortality, and consequences for mental health and human well-being. For countries at all levels of development, these impacts are consistent with a significant lack of preparedness for current climate variability in some sectors.[14]

[10] 4.2-4, 5.3-4, 6.1, 6.3-4, 18.3, 18.5, 22.3, 24.4, 25.6, 28.2, 30.4-5, Boxes 4-2, 4-3, 25-3, CC-CR, and CC-MB
[11] 7.2, 18.4, 22.3, 26.5, Figures 7-2, 7-3, and 7-7
[12] 11.4-6, 18.4, 25.8
[13] 8.1-2, 9.3-4, 10.9, 11.1, 11.3-5, 12.2-5, 13.1-3, 14.1-3, 18.4, 19.6, 23.5, 25.8, 26.6, 26.8, 28.4, Box CC-GC
[14] 3.2, 4.2-3, 8.1, 9.3, 10.7, 11.3, 11.7, 13.2, 14.1, 18.6, 22.3, 25.6-8, 26.6-7, 30.5, Tables 18-3 and 23-1, Figure 26-2, Boxes 4-3, 4-4, 25-5, 25-6, 25-8, and CC-CR

Climate-related hazards exacerbate other stressors, often with negative outcomes for livelihoods, especially for people living in poverty (*high confidence*). Climate-related hazards affect poor people's lives directly through impacts on livelihoods, reductions in crop yields, or destruction of homes and indirectly through, for example, increased food prices and food insecurity. Observed positive effects for poor and marginalized people, which are limited and often indirect, include examples such as diversification of social networks and of agricultural practices.[15]

Violent conflict increases vulnerability to climate change (*medium evidence, high agreement*). Large-scale violent conflict harms assets that facilitate adaptation, including infrastructure, institutions, natural resources, social capital, and livelihood opportunities.[16]

A-2. Adaptation Experience

Throughout history, people and societies have adjusted to and coped with climate, climate variability, and extremes, with varying degrees of success. This section focuses on adaptive human responses to observed and projected climate-change impacts, which can also address broader risk-reduction and development objectives.

Adaptation is becoming embedded in some planning processes, with more limited implementation of responses (*high confidence*). Engineered and technological options are commonly implemented adaptive responses, often integrated within existing programs such as disaster risk management and water management. There is increasing recognition of the value of social, institutional, and ecosystem-based measures and of the extent of constraints to adaptation. Adaptation options adopted to date continue to emphasize incremental adjustments and co-benefits and are starting to emphasize flexibility and learning (*medium evidence, medium agreement*). Most assessments of adaptation have been restricted to impacts, vulnerability, and adaptation planning, with very few assessing the processes of implementation or the effects of adaptation actions (*medium evidence, high agreement*).[17]

Adaptation experience is accumulating across regions in the public and private sector and within communities (*high confidence*). Governments at various levels are starting to develop adaptation plans and policies and to integrate climate-change considerations into broader development plans. Examples of adaptation across regions include the following.

- In Africa, most national governments are initiating governance systems for adaptation. Disaster risk management, adjustments in technologies and infrastructure, ecosystem-based approaches, basic public health measures, and livelihood diversification are reducing vulnerability, although efforts to date tend to be isolated.[18]

[15] 8.2-3, 9.3, 11.3, 13.1-3, 22.3, 24.4, 26.8
[16] 12.5, 19.2, 19.6
[17] 4.4, 5.5, 6.4, 8.3, 9.4, 11.7, 14.1, 14.3-4, 15.2-5, 17.2-3, 21.3, 21.5, 22.4, 23.7, 25.4, 26.8-9, 30.6, Boxes 25-1, 25-2, 25-9, and CC-EA
[18] 22.4

- In Europe, adaptation policy has been developed across all levels of government, with some adaptation planning integrated into coastal and water management, into environmental protection and land planning, and into disaster risk management.[19]
- In Asia, adaptation is being facilitated in some areas through mainstreaming climate adaptation action into subnational development planning, early warning systems, integrated water resources management, agroforestry, and coastal reforestation of mangroves. [20]
- In Australasia, planning for sea-level rise, and in southern Australia for reduced water availability, is becoming adopted widely. Planning for sea-level rise has evolved considerably over the past two decades and shows a diversity of approaches, although its implementation remains piecemeal.[21]
- In North America, governments are engaging in incremental adaptation assessment and planning, particularly at the municipal level. Some proactive adaptation is occurring to protect longer-term investments in energy and public infrastructure.[22]
- In Central and South America, ecosystem-based adaptation including protected areas, conservation agreements, and community management of natural areas is occurring. Resilient crop varieties, climate forecasts, and integrated water resources management are being adopted within the agricultural sector in some areas.[23]
- In the Arctic, some communities have begun to deploy adaptive co-management strategies and communications infrastructure, combining traditional and scientific knowledge.[24]
- In small islands, which have diverse physical and human attributes, community-based adaptation has been shown to generate larger benefits when delivered in conjunction with other development activities.[25]
- In the ocean, international cooperation and marine spatial planning are starting to facilitate adaptation to climate change, with constraints from challenges of spatial scale and governance issues.[26]

A-3. The Decision-making Context

Climate variability and extremes have long been important in many decision-making contexts. Climate-related risks are now evolving over time due to both climate change and development. This section builds from existing experience with decision-making and risk management. It creates a foundation for understanding the report's assessment of future climate-related risks and potential responses.

Responding to climate-related risks involves decision-making in a changing world, with continuing uncertainty about the severity and timing of climate-change impacts and with limits to the effectiveness of adaptation (*high confidence*). Iterative risk management is a useful framework for decision-making in complex situations characterized by large potential consequences, persistent uncertainties, long timeframes, potential for learning, and multiple

[19] 23.7, Boxes 5-1 and 23-3
[20] 24.4-6, 24.9 Box CC-TC
[21] 25.4, 25.10, Table 25-2, Boxes 25-1, 25-2, and 25-9
[22] 26.7-9
[23] 27.3
[24] 28.2, 28.4
[25] 29.3, 29.6, Table 29-3, Figure 29-1
[26] 30.6

climatic and non-climatic influences changing over time. See Figure SPM.3. Assessment of the widest possible range of potential impacts, including low-probability outcomes with large consequences, is central to understanding the benefits and tradeoffs of alternative risk management actions. The complexity of adaptation actions across scales and contexts means that monitoring and learning are important components of effective adaptation.[27]

Figure SPM.3: Climate-change adaptation as an iterative risk management process with multiple feedbacks. People and knowledge shape the process and its outcomes. [Figure 2-1]

Adaptation and mitigation choices in the near-term will affect the risks of climate change throughout the 21st century (*high confidence*). Figure SPM.4 illustrates projected warming under a low-emission mitigation scenario and a high-emission scenario [Representative Concentration Pathways (RCPs) 2.6 and 8.5], along with observed temperature changes. The benefits of adaptation and mitigation occur over different but overlapping timeframes. Projected global temperature increase over the next few decades is similar across emission scenarios (Figure SPM.4B).[28] During this near-term period, risks will evolve as socioeconomic trends interact with the changing climate. Societal responses, particularly adaptations, will influence near-term outcomes. In the second half of the 21st century and beyond, global temperature increase diverges across emission scenarios (Figure SPM.4B and 4C).[29] For this longer-term period, near-term and longer-term adaptation and mitigation, as well as development pathways, will determine the risks of climate change.[30]

Figure SPM.4: Observed and projected changes in annual average surface temperature. This figure informs understanding of climate-related risks in the WGII AR5. It illustrates temperature change observed to date and projected warming under continued high emissions and under ambitious mitigation.

Technical details: (A) Map of observed annual average temperature change from 1901 to 2012, derived from a linear trend where sufficient data permit a robust estimate; other areas are white. Solid colors indicate areas where trends are significant at the 10% level. Diagonal lines indicate areas where trends are not significant. Observed data (range of grid-point values: -0.53 to 2.50°C over period) are from WGI AR5 Figures SPM.1 and 2.21. (B) Observed and projected future global annual average temperature relative to 1986-2005. Observed warming from 1850-1900 to 1986-2005 is 0.61°C (5-95% confidence interval: 0.55 to 0.67°C). Black lines show temperature estimates from three datasets. Blue and red lines and shading denote the ensemble mean and ±1.64 standard deviation range, based on CMIP5 simulations from 32 models for RCP2.6 and 39 models for RCP8.5. (C) CMIP5 multi-model mean projections of annual average temperature changes for 2081-2100 under RCP2.6 and 8.5, relative to 1986-2005. Solid colors indicate areas with very strong agreement, where the multi-model mean change is greater than twice the baseline variability (natural internal variability in 20-yr means) and ≥90% of models agree on sign of change. Colors with white dots indicate areas with strong agreement, where ≥66% of models show change greater than the baseline variability and ≥66% of models agree on sign of change. Gray indicates areas with divergent changes, where ≥66% of models show change

[27] 2.1-4, 3.6, 14.1-3, 15.2-4, 16.2-4, 17.1-3, 17.5, 20.6, 22.4, 25.4, Figure 1-5
[28] WGI AR5 11.3
[29] WGI AR5 12.4 and Table SPM.2
[30] 2.5, 21.2-3, 21.5, Box CC-RC

greater than the baseline variability, but <66% agree on sign of change. Colors with diagonal lines indicate areas with little or no change, where <66% of models show change greater than the baseline variability, although there may be significant change at shorter timescales such as seasons, months, or days. Analysis uses model data (range of grid-point values across RCP2.6 and 8.5: 0.06 to 11.71°C) from WGI AR5 Figure SPM.8, with full description of methods in Box CC-RC. See also Annex I of WGI AR5. [Boxes 21-2 and CC-RC; WGI AR5 2.4, Figures SPM.1, SPM.7, and 2.21]

Assessment of risks in the WGII AR5 relies on diverse forms of evidence. Expert judgment is used to integrate evidence into evaluations of risks. Forms of evidence include, for example, empirical observations, experimental results, process-based understanding, statistical approaches, and simulation and descriptive models. Future risks related to climate change vary substantially across plausible alternative development pathways, and the relative importance of development and climate change varies by sector, region, and time period (*high confidence*). Scenarios are useful tools for characterizing possible future socioeconomic pathways, climate change and its risks, and policy implications. Climate-model projections informing evaluations of risks in this report are generally based on the RCPs (Figure SPM.4), as well as the older IPCC Special Report on Emission Scenarios (SRES) scenarios.[31]

Uncertainties about future vulnerability, exposure, and responses of interlinked human and natural systems are large (*high confidence*). This motivates exploration of a wide range of socioeconomic futures in assessments of risks. Understanding future vulnerability, exposure, and response capacity of interlinked human and natural systems is challenging due to the number of interacting social, economic, and cultural factors, which have been incompletely considered to date. These factors include wealth and its distribution across society, demographics, migration, access to technology and information, employment patterns, the quality of adaptive responses, societal values, governance structures, and institutions to resolve conflicts. International dimensions such as trade and relations among states are also important for understanding the risks of climate change at regional scales.[32]

B) FUTURE RISKS AND OPPORTUNITIES FOR ADAPTATION

This section presents future risks and more limited potential benefits across sectors and regions, over the next few decades and in the second half of the 21st century and beyond. It examines how they are affected by the magnitude and rate of climate change and by socioeconomic choices. It also assesses opportunities for reducing impacts and managing risks through adaptation and mitigation.

B-1. Key Risks across Sectors and Regions

Key risks are potentially severe impacts relevant to Article 2 of the United Nations Framework Convention on Climate Change, which refers to "dangerous anthropogenic interference with the

[31] 1.1, 1.3, 2.2-3, 19.6, 20.2, 21.3, 21.5, 26.2, Box CC-RC; WGI AR5 Box SPM.1
[32] 11.3, 12.6, 21.3-5, 25.3-4, 25.11, 26.2

climate system." Risks are considered key due to high hazard or high vulnerability of societies and systems exposed, or both. Identification of key risks was based on expert judgment using the following specific criteria: large magnitude, high probability, or irreversibility of impacts; timing of impacts; persistent vulnerability or exposure contributing to risks; or limited potential to reduce risks through adaptation or mitigation. Key risks are integrated into five complementary and overarching reasons for concern (RFCs) in Assessment Box SPM.1.

The key risks that follow, all of which are identified with *high confidence*, span sectors and regions. Each of these key risks contributes to one or more RFCs.[33]

i. Risk of death, injury, ill-health, or disrupted livelihoods in low-lying coastal zones and small island developing states and other small islands, due to storm surges, coastal flooding, and sea-level rise.[34] [RFC 1-5]
ii. Risk of severe ill-health and disrupted livelihoods for large urban populations due to inland flooding in some regions.[35] [RFC 2 and 3]
iii. Systemic risks due to extreme weather events leading to breakdown of infrastructure networks and critical services such as electricity, water supply, and health and emergency services.[36] [RFC 2-4]
iv. Risk of mortality and morbidity during periods of extreme heat, particularly for vulnerable urban populations and those working outdoors in urban or rural areas.[37] [RFC 2 and 3]
v. Risk of food insecurity and the breakdown of food systems linked to warming, drought, flooding, and precipitation variability and extremes, particularly for poorer populations in urban and rural settings.[38] [RFC 2-4]
vi. Risk of loss of rural livelihoods and income due to insufficient access to drinking and irrigation water and reduced agricultural productivity, particularly for farmers and pastoralists with minimal capital in semi-arid regions.[39] [RFC 2 and 3]
vii. Risk of loss of marine and coastal ecosystems, biodiversity, and the ecosystem goods, functions, and services they provide for coastal livelihoods, especially for fishing communities in the tropics and the Arctic.[40] [RFC 1, 2, and 4]
viii. Risk of loss of terrestrial and inland water ecosystems, biodiversity, and the ecosystem goods, functions, and services they provide for livelihoods.[41] [RFC 1, 3, and 4]

Many key risks constitute particular challenges for the least developed countries and vulnerable communities, given their limited ability to cope.

Assessment Box SPM.1. Human Interference with the Climate System

Human influence on the climate system is clear.[42] Yet determining whether such influence constitutes "dangerous anthropogenic interference" in the words of Article 2 of the UNFCCC involves both risk assessment and value judgments. This report assesses risks across contexts and

[33] 19.2-4, 19.6, Table 19-4, Boxes 19-2 and CC-KR
[34] 5.4, 8.2, 13.2, 19.2-4, 19.6-7, 24.4-5, 26.7-8, 29.3, 30.3, Tables 19-4 and 26-1, Figure 26-2, Boxes 25-1, 25-7, and CC-KR
[35] 3.4-5, 8.2, 13.2, 19.6, 25.10, 26.3, 26.8, 27.3, Tables 19-4 and 26-1, Boxes 25-8 and CC-KR
[36] 5.4, 8.1-2, 9.3, 10.2-3, 12.6, 19.6, 23.9, 25.10, 26.7-8, 28.3, Table 19-4, Boxes CC-KR and CC-HS
[37] 8.1-2, 11.3-4, 11.6, 13.2, 19.3, 19.6, 23.5, 24.4, 25.8, 26.6, 26.8, Tables 19-4 and 26-1, Boxes CC-KR and CC-HS
[38] 3.5, 7.4-5, 8.2-3, 9.3, 11.3, 11.6, 13.2, 19.3-4, 19.6, 22.3, 24.4, 25.5, 25.7, 26.5, 26.8, 27.3, 28.2, 28.4, Table 19-4, Box CC-KR
[39] 3.4-5, 9.3, 12.2, 13.2, 19.3, 19.6, 24.4, 25.7, 26.8, Table 19-4, Boxes 25-5 and CC-KR
[40] 5.4, 6.3, 7.4, 9.3, 19.5-6, 22.3, 25.6, 27.3, 28.2-3, 29.3, 30.5-7, Table 19-4, Boxes CC-OA, CC-CR, CC-KR, and CC-HS
[41] 4.3, 9.3, 19.3-6, 22.3, 25.6, 27.3, 28.2-3, Table 19-4, Boxes CC-KR and CC-WE
[42] WGI AR5 SPM, 2.2, 6.3, 10.3-6, 10.9

through time, providing a basis for judgments about the level of climate change at which risks become dangerous.

Five integrative reasons for concern (RFCs) provide a framework for summarizing key risks across sectors and regions. First identified in the IPCC Third Assessment Report, the RFCs illustrate the implications of warming and of adaptation limits for people, economies, and ecosystems. They provide one starting point for evaluating dangerous anthropogenic interference with the climate system. Risks for each RFC, updated based on assessment of the literature and expert judgments, are presented below and in Assessment Box SPM.1 Figure 1. All temperatures below are given as global average temperature change relative to 1986-2005 ("recent").[43]

(1) ***Unique and threatened systems:*** Some unique and threatened systems, including ecosystems and cultures, are already at risk from climate change (*high confidence*). The number of such systems at risk of severe consequences is higher with additional warming of around 1°C. Many species and systems with limited adaptive capacity are subject to very high risks with additional warming of 2°C, particularly Arctic-sea-ice and coral-reef systems.

(2) ***Extreme weather events:*** Climate-change-related risks from extreme events, such as heat waves, extreme precipitation, and coastal flooding, are already moderate (*high confidence*) and high with 1°C additional warming (*medium confidence*). Risks associated with some types of extreme events (e.g., extreme heat) increase further at higher temperatures (*high confidence*).

(3) ***Distribution of impacts:*** Risks are unevenly distributed and are generally greater for disadvantaged people and communities in countries at all levels of development. Risks are already moderate because of regionally differentiated climate-change impacts on crop production in particular (*medium* to *high confidence*). Based on projected decreases in regional crop yields and water availability, risks of unevenly distributed impacts are high for additional warming above 2°C (*medium confidence*).

(4) ***Global aggregate impacts:*** Risks of global aggregate impacts are moderate for additional warming between 1-2°C, reflecting impacts to both Earth's biodiversity and the overall global economy (*medium confidence*). Extensive biodiversity loss with associated loss of ecosystem goods and services results in high risks around 3°C additional warming (*high confidence*). Aggregate economic damages accelerate with increasing temperature (*limited evidence, high agreement*) but few quantitative estimates have been completed for additional warming around 3°C or above.

(5) ***Large-scale singular events:*** With increasing warming, some physical systems or ecosystems may be at risk of abrupt and irreversible changes. Risks associated with such tipping points become moderate between 0-1°C additional warming, due to early warning signs that both warm-water coral reef and Arctic ecosystems are already experiencing irreversible regime shifts (*medium confidence*). Risks increase disproportionately as temperature increases between 1-2°C additional warming and become high above 3°C, due to the potential for a large and irreversible sea-level rise from ice sheet loss. For sustained warming greater than some threshold,[44] near-complete loss of the Greenland ice sheet would occur over a millennium or more, contributing up to 7m of global mean sea-level rise.

[43] 18.6, 19.6; observed warming from 1850-1900 to 1986-2005 is 0.61°C (5-95% confidence interval: 0.55 to 0.67°C) [WGI AR5 2.4].

[44] Current estimates indicate that this threshold is greater than about 1°C (*low confidence*) but less than about 4°C (*medium confidence*) sustained global mean warming above preindustrial levels. [WGI AR5 SPM, 5.8, 13.4-5]

Increasing magnitudes of warming increase the likelihood of severe, pervasive, and irreversible impacts. Some risks of climate change are considerable at 1 or 2°C above preindustrial levels (as shown in Assessment Box SPM.1). Global climate change risks are high to very high with global mean temperature increase of 4°C or more above preindustrial levels in all reasons for concern (Assessment Box SPM.1), and include severe and widespread impacts on unique and threatened systems, substantial species extinction, large risks to global and regional food security, and the combination of high temperature and humidity compromising normal human activities, including growing food or working outdoors in some areas for parts of the year (*high confidence*). The precise levels of climate change sufficient to trigger tipping points (thresholds for abrupt and irreversible change) remain uncertain, but the risk associated with crossing multiple tipping points in the earth system or in interlinked human and natural systems increases with rising temperature (*medium confidence*).[45]

The overall risks of climate change impacts can be reduced by limiting the rate and magnitude of climate change. Risks are reduced substantially under the assessed scenario with the lowest temperature projections (RCP2.6 – low emissions) compared to the highest temperature projections (RCP8.5 – high emissions), particularly in the second half of the 21st century (*very high confidence*). Reducing climate change can also reduce the scale of adaptation that might be required. Under all assessed scenarios for adaptation and mitigation, some risk from adverse impacts remains (*very high confidence*).[46]

Assessment Box SPM.1 Figure 1: A global perspective on climate-related risks. Risks associated with reasons for concern are shown at right for increasing levels of climate change. The color shading indicates the additional risk due to climate change when a temperature level is reached and then sustained or exceeded. Undetectable risk (white) indicates no associated impacts are detectable and attributable to climate change. Moderate risk (yellow) indicates that associated impacts are both detectable and attributable to climate change with at least *medium confidence*, also accounting for the other specific criteria for key risks. High risk (red) indicates severe and widespread impacts, also accounting for the other specific criteria for key risks. Purple, introduced in this assessment, shows that very high risk is indicated by all specific criteria for key risks. [Figure 19-4] For reference, past and projected global annual average surface temperature is shown at left, as in Figure SPM.4. [Figure RC-1, Box CC-RC; WGI AR5 Figures SPM.1 and SPM.7] Based on the longest global surface temperature dataset available, the observed change between the average of the period 1850–1900 and of the AR5 reference period (1986-2005) is 0.61°C (5-95% confidence interval: 0.55 to 0.67°C) [WGI AR5 SPM, 2.4], which is used here as an approximation of the change in global mean surface temperature since preindustrial times, referred to as the period before 1750. [WGI and WGII AR5 glossaries]

B-2. Sectoral Risks and Potential for Adaptation

Climate change is projected to amplify existing climate-related risks and create new risks for natural and human systems. Some of these risks will be limited to a particular sector or region,

[45] 4.2-3, 11.8, 19.5, 19.7, 26.5, Box CC-HS
[46] 3.4-5, 16.6, 17.2, 19.7, 20.3, 25.10, Tables 3-2, 8-3, and 8-6, Boxes 16-3 and 25-1

and others will have cascading effects. To a lesser extent, climate change is also projected to have some potential benefits.

Freshwater resources

Freshwater-related risks of climate change increase significantly with increasing greenhouse gas concentrations (*robust evidence, high agreement*). The fraction of global population experiencing water scarcity and the fraction affected by major river floods increase with the level of warming in the 21st century.[47]

Climate change over the 21st century is projected to reduce renewable surface water and groundwater resources significantly in most dry subtropical regions (*robust evidence, high agreement*), intensifying competition for water among sectors (*limited evidence, medium agreement*). In presently dry regions, drought frequency will *likely* increase by the end of the 21st century under RCP8.5 (*medium confidence*). In contrast, water resources are projected to increase at high latitudes (*robust evidence, high agreement*). Climate change is projected to reduce raw water quality and pose risks to drinking water quality even with conventional treatment, due to interacting factors: increased temperature; increased sediment, nutrient, and pollutant loadings from heavy rainfall; increased concentration of pollutants during droughts; and disruption of treatment facilities during floods (*medium evidence, high agreement*). Adaptive water management techniques, including scenario planning, learning-based approaches, and flexible and low-regret solutions, can help create resilience to uncertain hydrological changes and impacts due to climate change (*limited evidence, high agreement*).[48]

Terrestrial and freshwater ecosystems

A large fraction of both terrestrial and freshwater species faces increased extinction risk under projected climate change during and beyond the 21st century, especially as climate change interacts with other stressors, such as habitat modification, over-exploitation, pollution, and invasive species (*high confidence*). Extinction risk is increased under all RCP scenarios, with risk increasing with both magnitude and rate of climate change. Many species will be unable to track suitable climates under mid- and high-range rates of climate change (i.e., RCP4.5, 6.0, and 8.5) during the 21st century (*medium confidence*). Lower rates of change (i.e., RCP2.6) will pose fewer problems. See Figure SPM.5. Some species will adapt to new climates. Those that cannot adapt sufficiently fast will decrease in abundance or go extinct in part or all of their ranges. Management actions, such as maintenance of genetic diversity, assisted species migration and dispersal, manipulation of disturbance regimes (e.g., fires, floods), and reduction of other stressors, can reduce, but not eliminate, risks of impacts to terrestrial and freshwater ecosystems due to climate change, as well as increase the inherent capacity of ecosystems and their species to adapt to a changing climate (*high confidence*).[49]

[47] 3.4-5, 26.3, Table 3-2, Box 25-8
[48] 3.2, 3.4-6, 22.3, 23.9, 25.5, 26.3, Table 3-2, Table 23-3, Boxes 25-2, CC-RF, and CC-WE; WGI AR5 12.4
[49] 4.3-4, 25.6, 26.4, Box CC-RF

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Within this century, magnitudes and rates of climate change associated with medium- to high-emission scenarios (RCP4.5, 6.0, and 8.5) pose high risk of abrupt and irreversible regional-scale change in the composition, structure, and function of terrestrial and freshwater ecosystems, including wetlands (*medium confidence*). Examples that could lead to substantial impact on climate are the boreal-tundra Arctic system (*medium confidence*) and the Amazon forest (*low confidence*). Carbon stored in the terrestrial biosphere (e.g., in peatlands, permafrost, and forests) is susceptible to loss to the atmosphere as a result of climate change, deforestation, and ecosystem degradation (*high confidence*). Increased tree mortality and associated forest dieback is projected to occur in many regions over the 21st century, due to increased temperatures and drought (*medium confidence*). Forest dieback poses risks for carbon storage, biodiversity, wood production, water quality, amenity, and economic activity.[50]

Figure SPM.5: Maximum speeds at which species can move across landscapes (based on observations and models; vertical axis on left), compared with speeds at which temperatures are projected to move across landscapes (climate velocities for temperature; vertical axis on right). Human interventions, such as transport or habitat fragmentation, can greatly increase or decrease speeds of movement. White boxes with black bars indicate ranges and medians of maximum movement speeds for trees, plants, mammals, plant-feeding insects (median not estimated), and freshwater mollusks. For RCP2.6, 4.5, 6.0, and 8.5 for 2050-2090, horizontal lines show climate velocity for the global-land-area average and for large flat regions. Species with maximum speeds below each line are expected to be unable to track warming in the absence of human intervention. [Figure 4-5]

Coastal systems and low-lying areas

Due to sea-level rise projected throughout the 21st century and beyond, coastal systems and low-lying areas will increasingly experience adverse impacts such as submergence, coastal flooding, and coastal erosion (*very high confidence*). The population and assets projected to be exposed to coastal risks as well as human pressures on coastal ecosystems will increase significantly in the coming decades due to population growth, economic development, and urbanization (*high confidence*). The relative costs of coastal adaptation vary strongly among and within regions and countries for the 21st century. Some low-lying developing countries and small island states are expected to face very high impacts that, in some cases, could have associated damage and adaptation costs of several percentage points of GDP.[51]

Marine systems

Due to projected climate change by the mid 21st century and beyond, global marine-species redistribution and marine-biodiversity reduction in sensitive regions will challenge the sustained provision of fisheries productivity and other ecosystem services (*high confidence*). Spatial shifts of marine species due to projected warming will cause high-latitude invasions and high local-extinction rates in the tropics and semi-enclosed seas (*medium confidence*). Species

[50] 4.2-3, Figure 4-8, Boxes 4-2, 4-3, and 4-4
[51] 5.3-5, 8.2, 22.3, 24.4, 25.6, 26.3, 26.8, Table 26-1, Box 25-1

richness and fisheries catch potential are projected to increase, on average, at mid and high latitudes (*high confidence*) and decrease at tropical latitudes (*medium confidence*). See Figure SPM.6A. The progressive expansion of oxygen minimum zones and anoxic "dead zones" is projected to further constrain fish habitat. Open-ocean net primary production is projected to redistribute and, by 2100, fall globally under all RCP scenarios. Climate change adds to the threats of over-fishing and other non-climatic stressors, thus complicating marine management regimes (*high confidence*).[52]

For medium- to high-emission scenarios (RCP4.5, 6.0, and 8.5), ocean acidification poses substantial risks to marine ecosystems, especially polar ecosystems and coral reefs, associated with impacts on the physiology, behavior, and population dynamics of individual species from phytoplankton to animals (*medium* to *high confidence*). Highly calcified mollusks, echinoderms, and reef-building corals are more sensitive than crustaceans (*high confidence*) and fishes (*low confidence*), with potentially detrimental consequences for fisheries and livelihoods. See Figure SPM.6B. Ocean acidification acts together with other global changes (e.g., warming, decreasing oxygen levels) and with local changes (e.g., pollution, eutrophication) (*high confidence*). Simultaneous drivers, such as warming and ocean acidification, can lead to interactive, complex, and amplified impacts for species and ecosystems.[53]

Figure SPM.6: Climate change risks for fisheries. (A) Projected global redistribution of maximum catch potential of ~1000 exploited fish and invertebrate species. Projections compare the 10-year averages 2001-2010 and 2051-2060 using SRES A1B, without analysis of potential impacts of overfishing or ocean acidification. (B) Marine mollusk and crustacean fisheries (present-day estimated annual catch rates ≥0.005 tonnes km^{-2}) and known locations of cold- and warm-water corals, depicted on a global map showing the projected distribution of ocean acidification under RCP8.5 (pH change from 1986-2005 to 2081-2100). [WGI AR5 Figure SPM.8] The bottom panel compares sensitivity to ocean acidification across mollusks, crustaceans, and corals, vulnerable animal phyla with socioeconomic relevance (e.g., for coastal protection and fisheries). The number of species analyzed across studies is given for each category of elevated CO_2. For 2100, RCP scenarios falling within each CO_2 partial pressure (pCO_2) category are as follows: RCP4.5 for 500-650 μatm (approximately equivalent to ppm in the atmosphere), RCP6.0 for 651-850 μatm, and RCP8.5 for 851-1370 μatm. By 2150, RCP8.5 falls within the 1371-2900 μatm category. The control category corresponds to 380 μatm. [6.1, 6.3, 30.5, Figures 6-10 and 6-14; WGI AR5 Box SPM.1]

Food security and food production systems

For the major crops (wheat, rice, and maize) in tropical and temperate regions, climate change without adaptation is projected to negatively impact production for local temperature increases of 2°C or more above late-20th-century levels, although individual locations may benefit (*medium confidence*). Projected impacts vary across crops and regions and adaptation scenarios, with about 10% of projections for the period 2030-2049 showing yield gains of more than 10%, and about 10% of projections showing yield losses of more than 25%,

[52] 6.3-5, 7.4, 25.6, 28.3, 30.6-7, Boxes CC-MB and CC-PP
[53] 5.4, 6.3-5, 22.3, 25.6, 28.3, 30.5, Boxes CC-CR, CC-OA, and TS.7

compared to the late 20th century. After 2050 the risk of more severe yield impacts increases and depends on the level of warming. See Figure SPM.7. Climate change is projected to progressively increase inter-annual variability of crop yields in many regions. These projected impacts will occur in the context of rapidly rising crop demand.[54]

All aspects of food security are potentially affected by climate change, including food access, utilization, and price stability (*high confidence*). Redistribution of marine fisheries catch potential towards higher latitudes poses risk of reduced supplies, income, and employment in tropical countries, with potential implications for food security (*medium confidence*). Global temperature increases of ~4°C or more above late-20th-century levels, combined with increasing food demand, would pose large risks to food security globally and regionally (*high confidence*). Risks to food security are generally greater in low-latitude areas.[55]

Figure SPM.7: Summary of projected changes in crop yields, due to climate change over the 21st century. The figure includes projections for different emission scenarios, for tropical and temperate regions, and for adaptation and no-adaptation cases combined. Relatively few studies have considered impacts on cropping systems for scenarios where global mean temperatures increase by 4°C or more. For five timeframes in the near-term and long-term, data (n=1090) are plotted in the 20-year period on the horizontal axis that includes the midpoint of each future projection period. Changes in crop yields are relative to late-20th-century levels. Data for each timeframe sum to 100%. [Figure 7-5]

Urban areas

Many global risks of climate change are concentrated in urban areas (*medium confidence*). Steps that build resilience and enable sustainable development can accelerate successful climate-change adaptation globally. Heat stress, extreme precipitation, inland and coastal flooding, landslides, air pollution, drought, and water scarcity pose risks in urban areas for people, assets, economies, and ecosystems (*very high confidence*). Risks are amplified for those lacking essential infrastructure and services or living in poor-quality housing and exposed areas. Reducing basic service deficits, improving housing, and building resilient infrastructure systems could significantly reduce vulnerability and exposure in urban areas. Urban adaptation benefits from effective multi-level urban risk governance, alignment of policies and incentives, strengthened local government and community adaptation capacity, synergies with the private sector, and appropriate financing and institutional development (*medium confidence*). Increased capacity, voice, and influence of low-income groups and vulnerable communities and their partnerships with local governments also benefit adaptation.[56]

Rural areas

[54] 7.4-5, 22.3, 24.4, 25.7, 26.5, Table 7-2, Figures 7-4, 7-5, 7-6, 7-7, and 7-8
[55] 6.3-5, 7.4-5, 9.3, 22.3, 24.4, 25.7, 26.5, Table 7-3, Figures 7-1, 7-4, and 7-7, Box 7-1
[56] 3.5, 8.2-4, 22.3, 24.4-5, 26.8, Table 8-2, Boxes 25-9 and CC-HS

Major future rural impacts are expected in the near-term and beyond through impacts on water availability and supply, food security, and agricultural incomes, including shifts in production areas of food and non-food crops across the world (*high confidence*). These impacts are expected to disproportionately affect the welfare of the poor in rural areas, such as female-headed households and those with limited access to land, modern agricultural inputs, infrastructure, and education. Further adaptations for agriculture, water, forestry, and biodiversity can occur through policies taking account of rural decision-making contexts. Trade reform and investment can improve market access for small-scale farms (*medium confidence*).[57]

Key economic sectors and services

For most economic sectors, the impacts of drivers such as changes in population, age structure, income, technology, relative prices, lifestyle, regulation, and governance are projected to be large relative to the impacts of climate change (*medium evidence, high agreement*). Climate change is projected to reduce energy demand for heating and increase energy demand for cooling in the residential and commercial sectors (*robust evidence, high agreement*). Climate change is projected to affect energy sources and technologies differently, depending on resources (e.g., water flow, wind, insolation), technological processes (e.g., cooling), or locations (e.g., coastal regions, floodplains) involved. More severe and/or frequent extreme weather events and/or hazard types are projected to increase losses and loss variability in various regions and challenge insurance systems to offer affordable coverage while raising more risk-based capital, particularly in developing countries. Large-scale public-private risk reduction initiatives and economic diversification are examples of adaptation actions.[58]

Global economic impacts from climate change are difficult to estimate. Economic impact estimates completed over the past 20 years vary in their coverage of subsets of economic sectors and depend on a large number of assumptions, many of which are disputable, and many estimates do not account for catastrophic changes, tipping points, and many other factors.[59] With these recognized limitations, the incomplete estimates of global annual economic losses for additional temperature increases of ~2°C are between 0.2 and 2.0% of income (±1 standard deviation around the mean) (*medium evidence, medium agreement*). Losses are *more likely than not* to be greater, rather than smaller, than this range (*limited evidence, high agreement*). Additionally, there are large differences between and within countries. Losses accelerate with greater warming (*limited evidence, high agreement*), but few quantitative estimates have been completed for additional warming around 3°C or above. Estimates of the incremental economic impact of emitting carbon dioxide lie between a few dollars and several hundreds of dollars per tonne of carbon[60] (*robust evidence, medium agreement*). Estimates vary strongly with the assumed damage function and discount rate.[61]

[57] 9.3, 25.9, 26.8, 28.2, 28.4, Box 25-5
[58] 3.5, 10.2, 10.7, 10.10, 17.4-5, 25.7, 26.7-9, Box 25-7
[59] Disaster loss estimates are lowerbound estimates because many impacts, such as loss of human lives, cultural heritage, and ecosystem services, are difficult to value and monetize, and thus they are poorly reflected in estimates of losses. Impacts on the informal or undocumented economy as well as indirect economic effects can be very important in some areas and sectors, but are generally not counted in reported estimates of losses. [SREX 4.5.1, 4.5.3, 4.5.4]
[60] 1 tonne of carbon = 3.667 tonne of CO_2
[61] 10.9

Human health

Until mid-century, projected climate change will impact human health mainly by exacerbating health problems that already exist (*very high confidence*). Throughout the 21st century, climate change is expected to lead to increases in ill-health in many regions and especially in developing countries with low income, as compared to a baseline without climate change (*high confidence*). Examples include greater likelihood of injury, disease, and death due to more intense heat waves and fires (*very high confidence*); increased likelihood of under-nutrition resulting from diminished food production in poor regions (*high confidence*); risks from lost work capacity and reduced labor productivity in vulnerable populations; and increased risks from food- and water-borne diseases (*very high confidence*) and vector-borne diseases (*medium confidence*). Positive effects are expected to include modest reductions in cold-related mortality and morbidity in some areas due to fewer cold extremes (*low confidence*), geographical shifts in food production (*medium confidence*), and reduced capacity of vectors to transmit some diseases. But globally over the 21st century, the magnitude and severity of negative impacts are projected to increasingly outweigh positive impacts (*high confidence*). The most effective vulnerability reduction measures for health in the near-term are programs that implement and improve basic public health measures such as provision of clean water and sanitation, secure essential health care including vaccination and child health services, increase capacity for disaster preparedness and response, and alleviate poverty (*very high confidence*). By 2100 for the high-emission scenario RCP8.5, the combination of high temperature and humidity in some areas for parts of the year is projected to compromise normal human activities, including growing food or working outdoors (*high confidence*).[62]

Human security

Climate change over the 21st century is projected to increase displacement of people (*medium evidence, high agreement*). Displacement risk increases when populations that lack the resources for planned migration experience higher exposure to extreme weather events, in both rural and urban areas, particularly in developing countries with low income. Expanding opportunities for mobility can reduce vulnerability for such populations. Changes in migration patterns can be responses to both extreme weather events and longer-term climate variability and change, and migration can also be an effective adaptation strategy. There is *low confidence* in quantitative projections of changes in mobility, due to its complex, multi-causal nature.[63]

Climate change can indirectly increase risks of violent conflicts in the form of civil war and inter-group violence by amplifying well-documented drivers of these conflicts such as poverty and economic shocks (*medium confidence*). Multiple lines of evidence relate climate variability to these forms of conflict.[64]

The impacts of climate change on the critical infrastructure and territorial integrity of many states are expected to influence national security policies (*medium evidence, medium*

[62] 8.2, 11.3-8, 19.3, 22.3, 25.8, 26.6, Figure 25-5, Box CC-HS
[63] 9.3, 12.4, 19.4, 22.3, 25.9
[64] 12.5, 13.2, 19.4

***agreement*).** For example, land inundation due to sea-level rise poses risks to the territorial integrity of small-island states and states with extensive coastlines. Some transboundary impacts of climate change, such as changes in sea ice, shared water resources, and pelagic fish stocks, have the potential to increase rivalry among states, but robust national and intergovernmental institutions can enhance cooperation and manage many of these rivalries.[65]

Livelihoods and poverty

Throughout the 21st century, climate-change impacts are projected to slow down economic growth, make poverty reduction more difficult, further erode food security, and prolong existing and create new poverty traps, the latter particularly in urban areas and emerging hotspots of hunger (*medium confidence*). Climate-change impacts are expected to exacerbate poverty in most developing countries and create new poverty pockets in countries with increasing inequality, in both developed and developing countries. In urban and rural areas, wage-labor-dependent poor households that are net buyers of food are expected to be particularly affected due to food price increases, including in regions with high food insecurity and high inequality (particularly in Africa), although the agricultural self-employed could benefit. Insurance programs, social protection measures, and disaster risk management may enhance long-term livelihood resilience among poor and marginalized people, if policies address poverty and multidimensional inequalities.[66]

B-3. Regional Key Risks and Potential for Adaptation

Risks will vary through time across regions and populations, dependent on myriad factors including the extent of adaptation and mitigation. A selection of key regional risks identified with *medium* to *high confidence* is presented in Assessment Box SPM.2. For extended summary of regional risks and potential benefits, see Technical Summary Section B-3 and WGII AR5 Part B: Regional Aspects.

Assessment Box SPM.2. Regional Key Risks

This Assessment Box highlights several representative key risks for each region. Key risks have been identified based on assessment of the relevant scientific, technical, and socioeconomic literature detailed in supporting chapter sections. Identification of key risks was based on expert judgment using the following specific criteria: large magnitude, high probability, or irreversibility of impacts; timing of impacts; persistent vulnerability or exposure contributing to risks; or limited potential to reduce risks through adaptation or mitigation.

For each key risk, risk levels were assessed for three timeframes. For the present, risk levels were estimated for current adaptation and a hypothetical highly adapted state, identifying where current adaptation deficits exist. For two future timeframes, risk levels were estimated for a

[65] 12.5-6, 23.9, 25.9
[66] 8.1, 8.3-4, 9.3, 10.9, 13.2-4, 22.3, 26.8

continuation of current adaptation and for a highly adapted state, representing the potential for and limits to adaptation.

The risk levels integrate probability and consequence over the widest possible range of potential outcomes, based on available literature. These potential outcomes result from the interaction of climate-related hazards, vulnerability, and exposure. Each risk level reflects total risk from climatic and non-climatic factors. Key risks and risk levels vary across regions and over time, given differing socioeconomic development pathways, vulnerability and exposure to hazards, adaptive capacity, and risk perceptions. Risk levels are not necessarily comparable, especially across regions, because the assessment considers potential impacts and adaptation in different physical, biological, and human systems across diverse contexts. This assessment of risks acknowledges the importance of differences in values and objectives in interpretation of the assessed risk levels.

Assessment Box SPM.2 Table 1: Key regional risks from climate change and the potential for reducing risks through adaptation and mitigation. Each key risk is characterized as very low to very high for three timeframes: the present, near-term (here, assessed over 2030-2040), and longer-term (here, assessed over 2080-2100). In the near-term, projected levels of global mean temperature increase do not diverge substantially for different emission scenarios. For the longer-term, risk levels are presented for two scenarios of global mean temperature increase (2°C and 4°C above preindustrial levels). These scenarios illustrate the potential for mitigation and adaptation to reduce the risks related to climate change. Climate-related drivers of impacts are indicated by icons.

C) MANAGING FUTURE RISKS AND BUILDING RESILIENCE

Managing the risks of climate change involves adaptation and mitigation decisions with implications for future generations, economies, and environments. This section evaluates adaptation as a means to build resilience and to adjust to climate-change impacts. It also considers limits to adaptation, climate-resilient pathways, and the role of transformation. See Figure SPM.8 for an overview of responses for addressing risk related to climate change.

Figure SPM.8: The solution space. Core concepts of the WGII AR5, illustrating overlapping entry points and approaches, as well as key considerations, in managing risks related to climate change, as assessed in this report and presented throughout this SPM. Bracketed references indicate sections of this summary with corresponding assessment findings.

C-1. Principles for Effective Adaptation

Adaptation is place and context specific, with no single approach for reducing risks appropriate across all settings (*high confidence*). Effective risk reduction and adaptation strategies consider the dynamics of vulnerability and exposure and their linkages with

socioeconomic processes, sustainable development, and climate change. Specific examples of responses to climate change are presented in Table SPM.1.[67]

Table SPM.1: Approaches for managing the risks of climate change. These approaches should be considered overlapping rather than discrete, and they are often pursued simultaneously. Mitigation is considered essential for managing the risks of climate change. It is not addressed in this table as mitigation is the focus of WGIII AR5. Examples are presented in no specific order and can be relevant to more than one category. [14.2-3, Table 14-1]

Adaptation planning and implementation can be enhanced through complementary actions across levels, from individuals to governments (*high confidence*). National governments can coordinate adaptation efforts of local and subnational governments, for example by protecting vulnerable groups, by supporting economic diversification, and by providing information, policy and legal frameworks, and financial support (*robust evidence, high agreement*). Local government and the private sector are increasingly recognized as critical to progress in adaptation, given their roles in scaling up adaptation of communities, households, and civil society and in managing risk information and financing (*medium evidence, high agreement*).[68]

A first step towards adaptation to future climate change is reducing vulnerability and exposure to present climate variability (*high confidence*). Strategies include actions with co-benefits for other objectives. Available strategies and actions can increase resilience across a range of possible future climates while helping to improve human health, livelihoods, social and economic well-being, and environmental quality. See Table SPM.1. Integration of adaptation into planning and decision-making can promote synergies with development and disaster risk reduction.[69]

Adaptation planning and implementation at all levels of governance are contingent on societal values, objectives, and risk perceptions (*high confidence*). Recognition of diverse interests, circumstances, social-cultural contexts, and expectations can benefit decision-making processes. Indigenous, local, and traditional knowledge systems and practices, including indigenous peoples' holistic view of community and environment, are a major resource for adapting to climate change, but these have not been used consistently in existing adaptation efforts. Integrating such forms of knowledge with existing practices increases the effectiveness of adaptation.[70]

Decision support is most effective when it is sensitive to context and the diversity of decision types, decision processes, and constituencies (*robust evidence, high agreement*). Organizations bridging science and decision-making, including climate services, play an important role in the communication, transfer, and development of climate-related knowledge, including translation, engagement, and knowledge exchange (*medium evidence, high agreement*).[71]

[67] 2.1, 8.3-4, 13.1, 13.3-4, 15.2-3, 15.5, 16.2-3, 16.5, 17.2, 17.4, 19.6, 21.3, 22.4, 26.8-9, 29.6, 29.8
[68] 2.1-4, 3.6, 5.5, 8.3-4, 9.3-4, 14.2, 15.2-3, 15.5, 16.2-5, 17.2-3, 22.4, 24.4, 25.4, 26.8-9, 30.7, Tables 21-1, 21-5, & 21-6, Box 16-2
[69] 3.6, 8.3, 9.4, 14.3, 15.2-3, 17.2, 20.4, 20.6, 22.4, 24.4-5, 25.4, 25.10, 27.3-5, 29.6, Boxes 25-2 and 25-6
[70] 2.2-4, 9.4, 12.3, 13.2, 15.2, 16.2-4, 16.7, 17.2-3, 21.3, 22.4, 24.4, 24.6, 25.4, 25.8, 26.9, 28.2, 28.4, Table 15-1, Box 25-7
[71] 2.1-4, 8.4, 14.4, 16.2-3, 16.5, 21.2-3, 21.5, 22.4, Box 9-4

Existing and emerging economic instruments can foster adaptation by providing incentives for anticipating and reducing impacts (*medium confidence*). Instruments include public-private finance partnerships, loans, payments for environmental services, improved resource pricing, charges and subsidies, norms and regulations, and risk sharing and transfer mechanisms. Risk financing mechanisms in the public and private sector, such as insurance and risk pools, can contribute to increasing resilience, but without attention to major design challenges, they can also provide disincentives, cause market failure, and decrease equity. Governments often play key roles as regulators, providers, or insurers of last resort.[72]

Constraints can interact to impede adaptation planning and implementation (*high confidence*). Common constraints on implementation arise from the following: limited financial and human resources; limited integration or coordination of governance; uncertainties about projected impacts; different perceptions of risks; competing values; absence of key adaptation leaders and advocates; and limited tools to monitor adaptation effectiveness. Another constraint includes insufficient research, monitoring, and observation and the finance to maintain them. Underestimating the complexity of adaptation as a social process can create unrealistic expectations about achieving intended adaptation outcomes.[73]

Poor planning, overemphasizing short-term outcomes, or failing to sufficiently anticipate consequences can result in maladaptation (*medium evidence, high agreement*). Maladaptation can increase the vulnerability or exposure of the target group in the future, or the vulnerability of other people, places, or sectors. Some near-term responses to increasing risks related to climate change may also limit future choices. For example, enhanced protection of exposed assets can lock in dependence on further protection measures.[74]

Limited evidence indicates a gap between global adaptation needs and the funds available for adaptation (*medium confidence*). There is a need for a better assessment of global adaptation costs, funding, and investment. Studies estimating the global cost of adaptation are characterized by shortcomings in data, methods, and coverage (*high confidence*).[75]

Significant co-benefits, synergies, and tradeoffs exist between mitigation and adaptation and among different adaptation responses; interactions occur both within and across regions (*very high confidence*). Increasing efforts to mitigate and adapt to climate change imply an increasing complexity of interactions, particularly at the intersections among water, energy, land use, and biodiversity, but tools to understand and manage these interactions remain limited. Examples of actions with co-benefits include (i) improved energy efficiency and cleaner energy sources, leading to reduced emissions of health-damaging climate-altering air pollutants; (ii) reduced energy and water consumption in urban areas through greening cities and recycling water; (iii) sustainable agriculture and forestry; and (iv) protection of ecosystems for carbon storage and other ecosystem services.[76]

[72] 10.7, 10.9, 13.3, 17.4-5, Box 25-7
[73] 3.6, 4.4, 5.5, 8.4, 9.4, 13.2-3, 14.2, 14.5, 15.2-3, 15.5, 16.2-3, 16.5, 17.2-3, 22.4, 23.7, 24.5, 25.4, 25.10, 26.8-9, 30.6, Table 16-3, Boxes 16-1 and 16-3
[74] 5.5, 8.4, 14.6, 15.5, 16.3, 17.2-3, 20.2, 22.4, 24.4, 25.10, 26.8, Table 14-4, Box 25-1
[75] 14.2, 17.4, Tables 17-2 and 17-3
[76] 2.4-5, 3.7, 4.2, 4.4, 5.4-5, 8.4, 9.3, 11.9, 13.3, 17.2, 19.3-4, 20.2-5, 21.4, 22.6, 23.8, 24.6, 25.6-7, 25.9, 26.8-9, 27.3, 29.6-8, Boxes 25-2, 25-9, 25-10, 30.6-7, CC-WE, and CC-RF

C-2. Climate-resilient Pathways and Transformation

Climate-resilient pathways are sustainable-development trajectories that combine adaptation and mitigation to reduce climate change and its impacts. They include iterative processes to ensure that effective risk management can be implemented and sustained. See Figure SPM.9.[77]

Figure SPM.9: Opportunity space and climate-resilient pathways. (a) Our world [A-1, B-1] is threatened by multiple stressors that impinge on resilience from many directions, represented here simply as biophysical and social stressors. Stressors include climate change, climate variability, land-use change, degradation of ecosystems, poverty and inequality, and cultural factors. (b) Opportunity space [A-2, A-3, B-2, C-1, C-2] refers to decision points and pathways that lead to a range of (c) possible futures [C, B-3] with differing levels of resilience and risk. (d) Decision points result in actions or failures-to-act throughout the opportunity space, and together they constitute the process of managing or failing to manage risks related to climate change. (e) Climate-resilient pathways (in green) within the opportunity space lead to a more resilient world through adaptive learning, increasing scientific knowledge, effective adaptation and mitigation measures, and other choices that reduce risks. (f) Pathways that lower resilience (in red) can involve insufficient mitigation, maladaptation, failure to learn and use knowledge, and other actions that lower resilience; and they can be irreversible in terms of possible futures.

Prospects for climate-resilient pathways for sustainable development are related fundamentally to what the world accomplishes with climate-change mitigation (*high confidence*). Since mitigation reduces the rate as well as the magnitude of warming, it also increases the time available for adaptation to a particular level of climate change, potentially by several decades. Delaying mitigation actions may reduce options for climate-resilient pathways in the future.[78]

Greater rates and magnitude of climate change increase the likelihood of exceeding adaptation limits (*high confidence*). Limits to adaptation occur when adaptive actions to avoid intolerable risks for an actor's objectives or for the needs of a system are not possible or are not currently available. Value-based judgments of what constitutes an intolerable risk may differ. Limits to adaptation emerge from the interaction among climate change and biophysical and/or socioeconomic constraints. Opportunities to take advantage of positive synergies between adaptation and mitigation may decrease with time, particularly if limits to adaptation are exceeded. In some parts of the world, insufficient responses to emerging impacts are already eroding the basis for sustainable development.[79]

Transformations in economic, social, technological, and political decisions and actions can enable climate-resilient pathways (*high confidence*). Specific examples are presented in Table SPM.1. Strategies and actions can be pursued now that will move towards climate-resilient pathways for sustainable development, while at the same time helping to improve livelihoods, social and economic well-being, and responsible environmental management. At the national

[77] 2.5, 20.3-4
[78] 1.1, 19.7, 20.2-3, 20.6, Figure 1-5
[79] 1.1, 11.8, 13.4, 16.2-7, 17.2, 20.2-3, 20.5-6, 25.10, 26.5, Boxes 16-1, 16-3, and 16-4

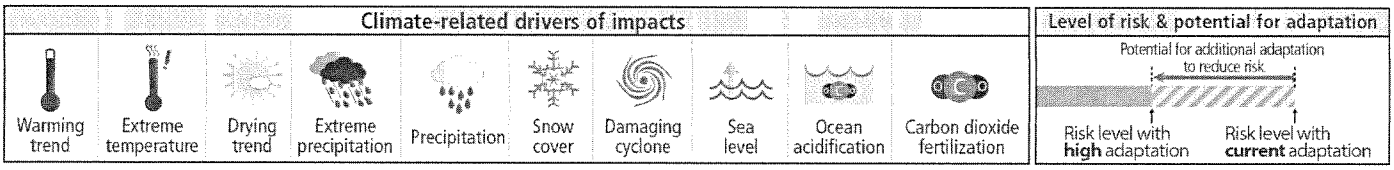
level, transformation is considered most effective when it reflects a country's own visions and approaches to achieving sustainable development in accordance with their national circumstances and priorities. Transformations to sustainability are considered to benefit from iterative learning, deliberative processes, and innovation.[80]

SUPPLEMENTARY MATERIAL

Table SPM.A1: Observed impacts attributed to climate change reported in the scientific literature since the AR4. These impacts have been attributed to climate change with *very low*, *low*, *medium*, or *high confidence*, with the relative contribution of climate change to the observed change indicated (major or minor), for natural and human systems across eight major world regions over the past several decades. [Tables 18-5, 18-6, 18-7, 18-8, and 18-9] Absence from the table of additional impacts attributed to climate change does not imply that such impacts have not occurred.

[80] 1.1, 2.1, 2.5, 8.4, 14.1, 14.3, 16.2-7, 20.5, 22.4, 25.4, 25.10, Figure 1-5, Boxes 16-1, 16-4, and TS.8

Assessment Box SPM.2 Table 1.



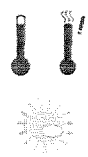
Africa

Key risk	Adaptation issues & prospects	Climatic drivers	Timeframe	Risk & potential for adaptation
Compounded stress on water resources facing significant strain from overexploitation and degradation at present and increased demand in the future, with drought stress exacerbated in drought-prone regions of Africa (*high confidence*) [22.3-4]	• Reducing non-climate stressors on water resources • Strengthening institutional capacities for demand management, groundwater assessment, integrated water-wastewater planning, and integrated land and water governance • Sustainable urban development		Present Near-term (2030-2040) Long-term (2080-2100) 2°C 4°C	Very low – Medium – Very high
Reduced crop productivity associated with heat and drought stress, with strong adverse effects on regional, national, and household livelihood and food security, also given increased pest and disease damage and flood impacts on food system infrastructure (*high confidence*) [22.3-4]	• Technological adaptation responses (e.g., stress-tolerant crop varieties, irrigation, enhanced observation systems) • Enhancing smallholder access to credit and other critical production resources; Diversifying livelihoods • Strengthening institutions at local, national, and regional levels to support agriculture (including early warning systems) and gender-oriented policy • Agronomic adaptation responses (e.g., agroforestry, conservation agriculture)		Present Near-term (2030-2040) Long-term (2080-2100) 2°C 4°C	Very low – Medium – Very high
Changes in the incidence and geographic range of vector- and water-borne diseases due to changes in the mean and variability of temperature and precipitation, particularly along the edges of their distribution (*medium confidence*) [22.3]	• Achieving development goals, particularly improved access to safe water and improved sanitation, and enhancement of public health functions such as surveillance • Vulnerability mapping and early warning systems • Coordination across sectors • Sustainable urban development		Present Near-term (2030-2040) Long-term (2080-2100) 2°C 4°C	Very low – Medium – Very high

Europe

Key risk	Adaptation issues & prospects	Climatic drivers	Timeframe	Risk & potential for adaptation
Increased economic losses and people affected by flooding in river basins and coasts, driven by increasing urbanization, increasing sea levels, coastal erosion, and peak river discharges (*high confidence*) [23.2-3, 23.7]	Adaptation can prevent most of the projected damages (*high confidence*). • Significant experience in hard flood-protection technologies and increasing experience with restoring wetlands • High costs for increasing flood protection • Potential barriers to implementation: demand for land in Europe and environmental and landscape concerns		Present Near-term (2030-2040) Long-term (2080-2100) 2°C 4°C	Very low – Medium – Very high
Increased water restrictions. Significant reduction in water availability from river abstraction and from groundwater resources, combined with increased water demand (e.g., for irrigation, energy and industry, domestic use) and with reduced water drainage and runoff as a result of increased evaporative demand, particularly in southern Europe (*high confidence*) [23.4, 23.7]	• Proven adaptation potential from adoption of more water-efficient technologies and of water-saving strategies (e.g., for irrigation, crop species, land cover, industries, domestic use) • Implementation of best practices and governance instruments in river basin management plans and integrated water management		Present Near-term (2030-2040) Long-term (2080-2100) 2°C 4°C	Very low – Medium – Very high
Increased economic losses and people affected by extreme heat events: impacts on health and well-being, labor productivity, crop production, air quality, and increasing risk of wildfires in southern Europe and in Russian boreal region (*medium confidence*) [23.3-7, Table 23-1]	• Implementation of warning systems • Adaptation of dwellings and workplaces and of transport and energy infrastructure • Reductions in emissions to improve air quality • Improved wildfire management • Development of insurance products against weather-related yield variations		Present Near-term (2030-2040) Long-term (2080-2100) 2°C 4°C	Very low – Medium – Very high

Asia

Key risk	Adaptation issues & prospects	Climatic drivers	Timeframe	Risk & potential for adaptation
Increased riverine, coastal, and urban flooding leading to widespread damage to infrastructure, livelihoods, and settlements in Asia (*medium confidence*) [24.4]	• Exposure reduction via structural and non-structural measures, effective land-use planning, and selective relocation • Reduction in the vulnerability of lifeline infrastructure and services (e.g., water, energy, waste management, food, biomass, mobility, local ecosystems, telecommunications) • Construction of monitoring and early warning systems; measures to identify exposed areas, assist vulnerable areas and households, and diversify livelihoods • Economic diversification		Present Near-term (2030-2040) Long-term (2080-2100) 2°C / 4°C	Very low – Medium – Very high
Increased risk of heat-related mortality (*high confidence*) [24.4]	• Heat health warning systems • Urban planning to reduce heat islands; improvement of the built environment; development of sustainable cities • New work practices to avoid heat stress among outdoor workers		Present Near-term (2030-2040) Long-term (2080-2100) 2°C / 4°C	Very low – Medium – Very high
Increased risk of drought-related water and food shortage causing malnutrition (*high confidence*) [24.4]	• Disaster preparedness including early-warning systems and local coping strategies • Adaptive/integrated water resource management • Water infrastructure and reservoir development • Diversification of water sources including water re-use • More efficient use of water (e.g., improved agricultural practices, irrigation management, and resilient agriculture)		Present Near-term (2030-2040) Long-term (2080-2100) 2°C / 4°C	Very low – Medium – Very high

Australasia

Key risk	Adaptation issues & prospects	Climatic drivers	Timeframe	Risk & potential for adaptation
Significant change in community composition and structure of coral reef systems in Australia (*high confidence*) [25.6, 30.5, Boxes CC-CR and CC-OA]	• Ability of corals to adapt naturally appears limited and insufficient to offset the detrimental effects of rising temperatures and acidification. • Other options are mostly limited to reducing other stresses (water quality, tourism, fishing) and early warning systems; direct interventions such as assisted colonization and shading have been proposed but remain untested at scale.		Present Near-term (2030-2040) Long-term (2080-2100) 2°C / 4°C	Very low – Medium – Very high
Increased frequency and intensity of flood damage to infrastructure and settlements in Australia and New Zealand (*high confidence*) [Table 25-1, Boxes 25-8 and 25-9]	• Significant adaptation deficit in some regions to current flood risk. • Effective adaptation includes land-use controls and relocation as well as protection and accommodation of increased risk to ensure flexibility.		Present Near-term (2030-2040) Long-term (2080-2100) 2°C / 4°C	Very low – Medium – Very high
Increasing risks to coastal infrastructure and low-lying ecosystems in Australia and New Zealand, with widespread damage towards the upper end of projected sea-level-rise ranges (*high confidence*) [25.6, 25.10, Box 25-1]	• Adaptation deficit in some locations to current coastal erosion and flood risk. Successive building and protection cycles constrain flexible responses. • Effective adaptation includes land-use controls and ultimately relocation as well as protection and accommodation.		Present Near-term (2030-2040) Long-term (2080-2100) 2°C / 4°C	Very low – Medium – Very high

North America

Key risk	Adaptation issues & prospects	Climatic drivers	Timeframe	Risk & potential for adaptation
Wildfire-induced loss of ecosystem integrity, property loss, human morbidity, and mortality as a result of increased drying trend and temperature trend (*high confidence*) [26.4, 26.8, Box 26-2]	• Some ecosystems are more fire-adapted than others. Forest managers and municipal planners are increasingly incorporating fire protection measures (e.g., prescribed burning, introduction of resilient vegetation). Institutional capacity to support ecosystem adaptation is limited. • Adaptation of human settlements is constrained by rapid private property development in high-risk areas and by limited household-level adaptive capacity. • Agroforestry can be an effective strategy for reduction of slash and burn practices in Mexico.		Present Near-term (2030-2040) Long-term (2080-2100) 2°C / 4°C	Very low – Medium – Very high

North America (continued)

Key risk	Adaptation issues & prospects	Climatic drivers	Timeframe	Risk & potential for adaptation (Very low / Medium / Very high)
Heat-related human mortality (*high confidence*) [26.6, 26.8]	• Residential air conditioning (A/C) can effectively reduce risk. However, availability and usage of A/C is highly variable and is subject to complete loss during power failures. Vulnerable populations include athletes and outdoor workers for whom A/C is not available. • Community- and household-scale adaptations have the potential to reduce exposure to heat extremes via family support, early heat warning systems, cooling centers, greening, and high-albedo surfaces.		Present Near-term (2030-2040) Long-term (2080-2100) 2°C Long-term (2080-2100) 4°C	
Urban floods in riverine and coastal areas, inducing property and infrastructure damage; supply chain, ecosystem, and social system disruption; public health impacts; and water quality impairment due to sea-level rise, extreme precipitation, and cyclones (*high confidence*) [26.2-4, 26.8]	• Implementing management of urban drainage is expensive and disruptive to urban areas. • Low-regret strategies with co-benefits include less impervious surfaces leading to more groundwater recharge, green infrastructure, and rooftop gardens. • Sea-level rise increases water elevations in coastal outfalls, which impedes drainage. In many cases, older rainfall design standards are being used that need to be updated to reflect current climate conditions. • Conservation of wetlands, including mangroves, and land-use planning strategies can reduce the intensity of flood events.		Present Near-term (2030-2040) Long-term (2080-2100) 2°C Long-term (2080-2100) 4°C	

Central and South America

Key risk	Adaptation issues & prospects	Climatic drivers	Timeframe	Risk & potential for adaptation (Very low / Medium / Very high)
Water availability in semi-arid and glacier-melt-dependent regions and Central America; flooding and landslides in urban and rural areas due to extreme precipitation (*high confidence*) [27.3]	• Integrated water resource management • Urban and rural flood management (including infrastructure), early warning systems, better weather and runoff forecasts, and infectious disease control		Present Near-term (2030-2040) Long-term (2080-2100) 2°C Long-term (2080-2100) 4°C	
Decreased food production and food quality (*medium confidence*) [27.3]	• Development of new crop varieties more adapted to climate change (temperature and drought) • Offsetting of human and animal health impacts of reduced food quality • Offsetting of economic impacts of land-use change • Strengthening traditional indigenous knowledge systems and practices		Present Near-term (2030-2040) Long-term (2080-2100) 2°C Long-term (2080-2100) 4°C	
Spread of vector-borne diseases in altitude and latitude (*high confidence*) [27.3]	• Development of early warning systems for disease control and mitigation based on climatic and other relevant inputs. Many factors augment vulnerability. • Establishing programs to extend basic public health services		Present Near-term (2030-2040) Long-term (2080-2100) 2°C Long-term (2080-2100) 4°C	not available not available

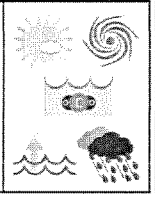
Polar Regions

Key risk	Adaptation issues & prospects	Climatic drivers	Timeframe	Risk & potential for adaptation (Very low / Medium / Very high)
Risks for freshwater and terrestrial ecosystems (*high confidence*) and marine ecosystems (*medium confidence*), due to changes in ice, snow cover, permafrost, and freshwater/ocean conditions, affecting species' habitat quality, ranges, phenology, and productivity, as well as dependent economies [28.2-4]	• Improved understanding through scientific and indigenous knowledge, producing more effective solutions and/or technological innovations • Enhanced monitoring, regulation, and warning systems that achieve safe and sustainable use of ecosystem resources • Hunting or fishing for different species, if possible, and diversifying income sources		Present Near-term (2030-2040) Long-term (2080-2100) 2°C Long-term (2080-2100) 4°C	
Risks for the health and well-being of Arctic residents, resulting from injuries and illness from the changing physical environment, food insecurity, lack of reliable and safe drinking water, and damage to infrastructure, including infrastructure in permafrost regions (*high confidence*) [28.2-4]	• Co-production of more robust solutions that combine science and technology with indigenous knowledge • Enhanced observation, monitoring, and warning systems • Improved communications, education, and training • Shifting resource bases, land use, and/or settlement areas		Present Near-term (2030-2040) Long-term (2080-2100) 2°C Long-term (2080-2100) 4°C	

Polar Regions (continued)

Key risk	Adaptation issues & prospects	Climatic drivers	Timeframe	Risk & potential for adaptation
Unprecedented challenges for northern communities due to complex inter-linkages between climate-related hazards and societal factors, particularly if rate of change is faster than social systems can adapt (*high confidence*) [28.2-4]	• Co-production of more robust solutions that combine science and technology with indigenous knowledge • Enhanced observation, monitoring, and warning systems • Improved communications, education, and training • Adaptive co-management responses developed through the settlement of land claims		Present Near-term (2030-2040) Long-term (2080-2100) 2°C 4°C	Very low – Medium – Very high

Small Islands

Key risk	Adaptation issues & prospects	Climatic drivers	Timeframe	Risk & potential for adaptation
Loss of livelihoods, coastal settlements, infrastructure, ecosystem services, and economic stability (*high confidence*) [29.6, 29.8, Figure 29-4]	• Significant potential exists for adaptation in islands, but additional external resources and technologies will enhance response. • Maintenance and enhancement of ecosystem functions and services and of water and food security • Efficacy of traditional community coping strategies is expected to be substantially reduced in the future.		Present Near-term (2030-2040) Long-term (2080-2100) 2°C 4°C	Very low – Medium – Very high
The interaction of rising global mean sea level in the 21st century with high-water-level events will threaten low-lying coastal areas (*high confidence*) [29.4, Table 29-1; WGI AR5 13.5, Table 13.5]	• High ratio of coastal area to land mass will make adaptation a significant financial and resource challenge for islands. • Adaptation options include maintenance and restoration of coastal landforms and ecosystems, improved management of soils and freshwater resources, and appropriate building codes and settlement patterns.		Present Near-term (2030-2040) Long-term (2080-2100) 2°C 4°C	Very low – Medium – Very high

The Ocean

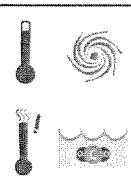
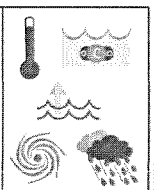
Key risk	Adaptation issues & prospects	Climatic drivers	Timeframe	Risk & potential for adaptation
Distributional shift in fish and invertebrate species, and decrease in fisheries catch potential at low latitudes, e.g., in equatorial upwelling and coastal boundary systems and sub-tropical gyres (*high confidence*) [6.3, 30.5-6, Tables 6-6 and 30-3, Box CC-MB]	• Evolutionary adaptation potential of fish and invertebrate species to warming is limited as indicated by their changes in distribution to maintain temperatures. • Human adaptation options: Large-scale translocation of industrial fishing activities following the regional decreases (low latitude) vs. possibly transient increases (high latitude) in catch potential; Flexible management that can react to variability and change; Improvement of fish resilience to thermal stress by reducing other stressors such as pollution and eutrophication; Expansion of sustainable aquaculture and the development of alternative livelihoods in some regions.		Present Near-term (2030-2040) Long-term (2080-2100) 2°C 4°C	Very low – Medium – Very high
Reduced biodiversity, fisheries abundance, and coastal protection by coral reefs due to heat-induced mass coral bleaching and mortality increases, exacerbated by ocean acidification, e.g., in coastal boundary systems and sub-tropical gyres (*high confidence*) [5.4, 6.4, 30.3, 30.5-6, Tables 6-6 and 30-3, Box CC-CR]	• Evidence of rapid evolution by corals is very limited. Some corals may migrate to higher latitudes, but entire reef systems are not expected to be able to track the high rates of temperature shifts. • Human adaptation options are limited to reducing other stresses, mainly by enhancing water quality, and limiting pressures from tourism and fishing. These options will delay human impacts of climate change by a few decades, but their efficacy will be severely reduced as thermal stress increases.		Present Near-term (2030-2040) Long-term (2080-2100) 2°C 4°C	Very low – Medium – Very high
Coastal inundation and habitat loss due to sea-level rise, extreme events, changes in precipitation, and reduced ecological resilience, e.g., in coastal boundary systems and sub-tropical gyres (*medium* to *high confidence*) [5.5, 30.5-6, Tables 6-6 and 30-3, Box CC-CR]	• Human adaptation options are limited to reducing other stresses, mainly by reducing pollution and limiting pressures from tourism, fishing, physical destruction, and unsustainable aquaculture. • Reducing deforestation and increasing reforestation of river catchments and coastal areas to retain sediments and nutrients • Increased mangrove, coral reef, and seagrass protection, and restoration to protect numerous ecosystem goods and services such as coastal protection, tourist value, and fish habitat		Present Near-term (2030-2040) Long-term (2080-2100) 2°C 4°C	Very low – Medium – Very high

Table SPM.1.

Overlapping Approaches	Category	Examples	Chapter Reference(s)
Vulnerability and exposure reduction through development, planning, & practices including many low-regrets measures	Human development	Improved access to education, nutrition, health facilities, energy, safe housing & settlement structures, & social support structures; Reduced gender inequality & marginalization in other forms.	8.3, 9.3, 13.1-3, 14.2-3, 22.4
	Poverty alleviation	Improved access to & control of local resources; Land tenure; Disaster risk reduction; Social safety nets & social protection; Insurance schemes.	8.3-4, 9.3, 13.1-3
	Livelihood security	Income, asset, & livelihood diversification; Improved infrastructure; Access to technology & decision-making fora; Increased decision-making power; Changed cropping, livestock, & aquaculture practices; Reliance on social networks.	7.5, 9.4, 13.1-3, 22.3-4, 23.4, 26.5, 27.3, 29.6, Table SM24-7
	Disaster risk management	Early warning systems; Hazard & vulnerability mapping; Diversifying water resources; Improved drainage; Flood & cyclone shelters; Building codes & practices; Storm & wastewater management; Transport & road infrastructure improvements.	8.2-4, 11.7, 14.3, 15.4, 22.4, 24.4, 26.6, 28.4, Box 25-1, Table 3-3
	Ecosystem management	Maintaining wetlands & urban green spaces; Coastal afforestation; Watershed & reservoir management; Reduction of other stressors on ecosystems & of habitat fragmentation; Maintenance of genetic diversity; Manipulation of disturbance regimes; Community-based natural resource management.	4.3-4, 8.3, 22.4, Table 3-3, Boxes 4-3, 8-2, 15-1, 25-8, 25-9, & CC-EA
	Spatial or land-use planning	Provisioning of adequate housing, infrastructure, & services; Managing development in flood prone & other high risk areas; Urban planning & upgrading programs; Land zoning laws; Easements; Protected areas.	4.4, 8.1-4, 22.4, 23.7-8, 27.3, Box 25-8
Adaptation including incremental and transformational adjustments	Structural/ physical	***Engineered & built-environment options:*** Sea walls & coastal protection structures; Flood levees; Water storage; Improved drainage; Flood & cyclone shelters; Building codes & practices; Storm & wastewater management; Transport & road infrastructure improvements; Floating houses; Power plant & electricity grid adjustments.	3.5-6, 5.5, 8.2-3, 10.2, 11.7, 23.3, 24.4, 25.7, 26.3, 26.8, Boxes 15-1, 25-1, 25-2, & 25-8
		Technological options: New crop & animal varieties; Indigenous, traditional, & local knowledge, technologies, & methods; Efficient irrigation; Water-saving technologies; Desalinization; Conservation agriculture; Food storage & preservation facilities; Hazard & vulnerability mapping & monitoring; Early warning systems; Building insulation; Mechanical & passive cooling; Technology development, transfer, & diffusion.	7.5, 8.3, 9.4, 10.3, 15.4, 22.4, 24.4, 26.3, 26.5, 27.3, 28.2, 28.4, 29.6-7, Boxes 20-5 & 25-2, Table 3-3, Table 15-1
		Ecosystem-based options: Ecological restoration; Soil conservation; Afforestation & reforestation; Mangrove conservation & replanting; Green infrastructure (e.g., shade trees, green roofs); Controlling overfishing; Fisheries co-management; Assisted species migration & dispersal; Ecological corridors; Seed banks, gene banks, & other ex situ conservation; Community-based natural resource management.	4.4, 5.5, 6.4, 8.3, 9.4, 11.7, 15.4, 22.4, 23.6-7, 24.4, 25.6, 27.3, 28.2, 29.7, 30.6, Boxes 15-1, 22-2, 25-9, 26-2, & CC-EA
		Services: Social safety nets & social protection; Food banks & distribution of food surplus; Municipal services including water & sanitation; Vaccination programs; Essential public health services; Enhanced emergency medical services.	3.5-6, 8.3, 9.3, 11.7, 11.9, 22.4, 29.6, Box 13-2
	Institutional	***Economic options:*** Financial incentives; Insurance; Catastrophe bonds; Payments for ecosystem services; Pricing water to encourage universal provision and careful use; Microfinance; Disaster contingency funds; Cash transfers; Public–private partnerships.	8.3-4, 9.4, 10.7, 11.7, 13.3, 15.4, 17.5, 22.4, 26.7, 27.6, 29.6, Box 25-7
		Laws & regulations: Land zoning laws; Building standards & practices; Easements; Water regulations & agreements; Laws to support disaster risk reduction; Laws to encourage insurance purchasing; Defined property rights & land tenure security; Protected areas; Fishing quotas; Patent pools & technology transfer.	4.4, 8.3, 9.3, 10.5, 10.7, 15.2, 15.4, 17.5, 22.4, 23.4, 23.7, 24.4, 25.4, 26.3, 27.3, 30.6, Table 25-2, Box CC-CR
		National & government policies & programs: National & regional adaptation plans including mainstreaming; Sub-national & local adaptation plans; Economic diversification; Urban upgrading programs; Municipal water management programs; Disaster planning & preparedness; Integrated water resource management; Integrated coastal zone management; Ecosystem-based management; Community-based adaptation.	2.4, 3.6, 4.4, 5.5, 6.4, 7.5, 8.3, 11.7, 15.2-5, 22.4, 23.7, 25.4, 25.8, 26.8-9, 27.3-4, 29.6, Boxes 25-1, 25-2, & 25-9, Table 9-2, Table 17-1
	Social	***Educational options:*** Awareness raising & integrating into education; Gender equity in education; Extension services; Sharing indigenous, traditional, & local knowledge; Participatory action research & social learning; Knowledge-sharing & learning platforms.	8.3-4, 9.4, 11.7, 12.3, 15.2-4, 22.4, 25.4, 28.4, 29.6, Table 15-1, Table 25-2
		Informational options: Hazard & vulnerability mapping; Early warning & response systems; Systematic monitoring & remote sensing; Climate services; Use of indigenous climate observations; Participatory scenario development; Integrated assessments.	2.4, 5.5, 8.3-4, 9.4, 11.7, 15.2-4, 22.4, 23.5, 24.4, 25.8, 26.6, 26.8, 27.3, 28.2, 28.5, 30.6, Table 25-2, Box 26-3
		Behavioral options: Household preparation & evacuation planning; Migration; Soil & water conservation; Storm drain clearance; Livelihood diversification; Changed cropping, livestock, & aquaculture practices; Reliance on social networks.	5.5, 7.5, 9.4, 12.4, 22.3-4, 23.4, 23.7, 25.7, 26.5, 27.3, 29.6, Table SM24-7, Box 25-5
Transformation	Spheres of change	***Practical:*** Social & technical innovations, behavioral shifts, or institutional & managerial changes that produce substantial shifts in outcomes.	8.3, 17.3, 20.5, Box 25-5
		Political: Political, social, cultural, & ecological decisions and actions consistent with reducing vulnerability & risk and supporting adaptation, mitigation, & sustainable development.	14.2-3, 20.5, 25.4, 30.7, Table 14-1
		Personal: Individual & collective assumptions, beliefs, values, & worldviews influencing climate-change responses.	14.2-3, 20.5, 25.4, Table 14-1

Table SPM.A1.

Africa	
Snow & Ice, Rivers & Lakes, Floods & Drought	• Retreat of tropical highland glaciers in East Africa (*high confidence*, Major contribution from climate change) • Reduced discharge in West African rivers (*low confidence*, Major contribution from climate change) • Lake surface warming & water column stratification increases in the Great Lakes & Lake Kariba (*high confidence*, Major contribution from climate change) • Increased soil moisture drought in the Sahel since 1970, partially wetter conditions since 1990 (*medium confidence*, Major contribution from climate change) [22.2-3, Tables 18-5, 18-6, & 22-3]
Terrestrial Ecosystems	• Tree density decreases in western Sahel & semi-arid Morocco, beyond changes due to land use (*medium confidence*, Major contribution from climate change) • Range shifts of several southern plants & animals, beyond changes due to land use (*medium confidence*, Major contribution from climate change) • Increases in wildfires on Mt. Kilimanjaro (*low confidence*, Major contribution from climate change) [22.3, Tables 18-7 & 22-3]
Coastal Erosion & Marine Ecosystems	Decline in coral reefs in tropical African waters, beyond decline due to human impacts (*high confidence*, Major contribution from climate change) [Table 18-8]
Food Production & Livelihoods	• Adaptive responses to changing rainfall by South African farmers, beyond changes due to economic conditions (*very low confidence*, Major contribution from climate change) • Decline in fruit-bearing trees in Sahel (*low confidence*, Major contribution from climate change) • Malaria increases in Kenyan highlands, beyond changes due to vaccination, drug resistance, demography, & livelihoods (*low confidence*, Minor contribution from climate change) • Reduced fisheries productivity of Great Lakes & Lake Kariba, beyond changes due to fisheries management & land use (*low confidence*, Minor contribution from climate change) [7.2, 11.5, 13.2, 22.3, Table 18-9]
Europe	
Snow & Ice, Rivers & Lakes, Floods & Drought	• Retreat of Alpine, Scandinavian, & Icelandic glaciers (*high confidence*, Major contribution from climate change) • Increase in rock slope failures in western Alps (*medium confidence*, Major contribution from climate change) • Changed occurrence of extreme river discharges & floods (*very low confidence*, Minor contribution from climate change) [18.3, 23.2-3, Tables 18-5 & 18-6; WGI AR5 4.3]
Terrestrial Ecosystems	• Earlier greening, leaf emergence, & fruiting in temperate & boreal trees (*high confidence*, Major contribution from climate change) • Increased colonization of alien plant species in Europe, beyond a baseline of some invasion (*medium confidence*, Major contribution from climate change) • Earlier arrival of migratory birds in Europe since 1970 (*medium confidence*, Major contribution from climate change) • Upward shift in tree-line in Europe, beyond changes due to land use (*low confidence*, Major contribution from climate change) • Increasing burnt forest areas during recent decades in Portugal & Greece, beyond some increase due to land use (*high confidence*, Major contribution from climate change) [4.3, 18.3, Tables 18-7 & 23-6]
Coastal Erosion & Marine Ecosystems	• Northward distributional shifts of zooplankton, fishes, seabirds, & benthic invertebrates in northeast Atlantic (*high confidence*, Major contribution from climate change) • Northward & depth shift in distribution of many fish species across European seas (*medium confidence*, Major contribution from climate change) • Plankton phenology changes in northeast Atlantic (*medium confidence*, Major contribution from climate change) • Spread of warm water species into the Mediterranean, beyond changes due to invasive species & human impacts (*medium confidence*, Major contribution from climate change) [6.3, 23.6, 30.5, Tables 6-2 & 18-8, Boxes 6-1 & CC-MB]
Food Production & Livelihoods	• Shift from cold-related mortality to heat-related mortality in England & Wales, beyond changes due to exposure & health care (*low confidence*, Major contribution from climate change) • Impacts on livelihoods of Sámi people in northern Europe, beyond effects of economic & sociopolitical changes (*medium confidence*, Major contribution from climate change) • Stagnation of wheat yields in some countries in recent decades, despite improved technology (*medium confidence*, Minor contribution from climate change) • Positive yield impacts for some crops mainly in northern Europe, beyond increase due to improved technology (*medium confidence*, Minor contribution from climate change) • Spread of bluetongue virus in sheep & of ticks across parts of Europe (*medium confidence*, Minor contribution from climate change) [18.4, 23.4-5, Table 18-9, Figure 7-2]

Asia	
Snow & Ice, Rivers & Lakes, Floods & Drought	• Permafrost degradation in Siberia, Central Asia, & Tibetan Plateau (*high confidence*, Major contribution from climate change) • Shrinking mountain glaciers across most of Asia (*medium confidence*, Major contribution from climate change)) • Changed water availability in many Chinese rivers, beyond changes due to land use (*low confidence*, Minor contribution from climate change) • Increased flow in four rivers due to shrinking glaciers in the Himalayas & Central Asia (*high confidence*, Major contribution from climate change) • Earlier timing of maximum spring flood in Russian rivers (*medium confidence*, Major contribution from climate change) • Reduced soil moisture in north-central & northeast China (1950-2006) (*medium confidence*, Major contribution from climate change) • Surface water degradation in parts of Asia, beyond changes due to land use (*medium confidence*, Minor contribution from climate change) [24.3-4, 28.2, Tables 18-5, 18-6, & SM24-4, Box 3-1; WGI AR5 4.3, 10.5]
Terrestrial Ecosystems	• Changes in plant phenology & growth in many parts of Asia (earlier greening), particularly in the north & east (*medium confidence*, Major contribution from climate change) • Distribution shifts of many plant & animal species upwards in elevation or polewards, particularly in the north of Asia (*medium confidence*, Major contribution from climate change) • Invasion of Siberian larch forests by pine & spruce during recent decades (*low confidence*, Major contribution from climate change) • Advance of shrubs into the Siberian tundra (*high confidence*, Major contribution from climate change) [4.3, 24.4, 28.2, Table 18-7, Figure 4-4]
Coastal Erosion & Marine Ecosystems	• Decline in coral reefs in tropical Asian waters, beyond decline due to human impacts (*high confidence*, Major contribution from climate change) • Northward range extension of corals in the East China Sea and western Pacific, and of a predatory fish in the Sea of Japan (*medium confidence*, Major contribution from climate change) • Shift from sardines to anchovies in the western North Pacific, beyond fluctuations due to fisheries (*low confidence*, Major contribution from climate change) • Increased coastal erosion in Arctic Asia (*low confidence*, Major contribution from climate change) [6.3, 24.4, 30.5, Tables 6-2 & 18-8]
Food Production & Livelihoods	• Impacts on livelihoods of indigenous groups in Arctic Russia, beyond economic & sociopolitical changes (*low confidence*, Major contribution from climate change) • Negative impacts on aggregate wheat yields in South Asia, beyond increase due to improved technology (*medium confidence*, Minor contribution from climate change) • Negative impacts on aggregate wheat & maize yields in China, beyond increase due to improved technology (*low confidence*, Minor contribution from climate change) • Increases in a water-borne disease in Israel (*low confidence*, Minor contribution from climate change) [7.2, 13.2, 18.4, 28.2, Tables 18-4 & 18-9, Figure 7-2]
Australasia	
Snow & Ice, Rivers & Lakes, Floods & Drought	• Significant decline in late-season snow depth at 3 of 4 alpine sites in Australia (1957-2002) (*medium confidence*, Major contribution from climate change) • Substantial reduction in ice & glacier ice volume in New Zealand (*medium confidence*, Major contribution from climate change) • Intensification of hydrological drought due to regional warming in southeast Australia (*low confidence*, Minor contribution from climate change) • Reduced inflow in river systems in southwestern Australia (since the mid-1970s) (*high confidence*, Major contribution from climate change) [25.5, Tables 18-5, 18-6, & 25-1; WGI AR5 4.3]
Terrestrial Ecosystems	• Changes in genetics, growth, distribution, & phenology of many species, in particular birds, butterflies, & plants in Australia, beyond fluctuations due to variable local climates, land use, pollution, & invasive species (*high confidence*, Major contribution from climate change) • Expansion of some wetlands & contraction of adjacent woodlands in southeast Australia (*low confidence*, Major contribution from climate change) • Expansion of monsoon rainforest at expense of savannah & grasslands in northern Australia (*medium confidence*, Major contribution from climate change) • Migration of glass eels advanced by several weeks in Waikato River, New Zealand (*low confidence*, Major contribution from climate change) [Tables 18-7 & 25-3]
Coastal Erosion & Marine Ecosystems	• Southward shifts in the distribution of marine species near Australia, beyond changes due to short-term environmental fluctuations, fishing, & pollution (*medium confidence*, Major contribution from climate change) • Change in timing of migration of seabirds in Australia (*low confidence*, Major contribution from climate change) • Increased coral bleaching in Great Barrier Reef & western Australian reefs, beyond effects from pollution & physical disturbance (*high confidence*, Major contribution from climate change) • Changed coral disease patterns at Great Barrier Reef, beyond effects from pollution (*medium confidence*, Major contribution from climate change) [6.3, 25.6, Tables 18-8 & 25-3]
Food Production & Livelihoods	• Advanced timing of wine-grape maturation in recent decades, beyond advance due to improved management (*medium confidence*, Major contribution from climate change) • Shift in winter vs. summer human mortality in Australia, beyond changes due to exposure & health care (*low confidence*, Major contribution from climate change) • Relocation or diversification of agricultural activities in Australia, beyond changes due to policy, markets, & short-term climate variability (*low confidence*, Minor contribution from climate change) [11.4, 18.4, 25.7-8, Tables 18-9 & 25-3, Box 25-5]
North America	
Snow & Ice, Rivers & Lakes, Floods & Drought	• Shrinkage of glaciers across western & northern North America (*high confidence*, Major contribution from climate change) • Decreasing amount of water in spring snowpack in western North America (1960-2002) (*high confidence*, Major contribution from climate change) • Shift to earlier peak flow in snow dominated rivers in western North America (*high confidence*, Major contribution from climate change) • Increased runoff in the midwestern and northeastern US (*medium confidence*, Minor contribution from climate change) [Tables 18-5 & 18-6; WGI AR5 2.6, 4.3]
Terrestrial Ecosystems	• Phenology changes & species distribution shifts upward in elevation & northward across multiple taxa (*medium confidence*, Major contribution from climate change) • Increased wildfire frequency in subarctic conifer forests & tundra (*medium confidence*, Major contribution from climate change) • Regional increases in tree mortality & insect infestations in forests (*low confidence*, Minor contribution from climate change) • Increase in wildfire activity, fire frequency & duration, & burnt area in forests of the western US and boreal forests in Canada, beyond changes due to land use & fire management (*medium confidence*, Minor contribution from climate change) [26.4, 28.2, Table 18-7, Box 26-2]
Coastal Erosion & Marine Ecosystems	• Northward distributional shifts of northwest Atlantic fish species (*high confidence*, Major contribution from climate change) • Changes in musselbeds along the west coast of US (*high confidence*, Major contribution from climate change) • Changed migration & survival of salmon in northeast Pacific (*high confidence*, Major contribution from climate change) • Increased coastal erosion in Alaska & Canada (*medium confidence*, Major contribution from climate change) [18.3, 30.5, Tables 6-2 & 18-8]
Food Production & Livelihoods	Impacts on livelihoods of indigenous groups in the Canadian Arctic, beyond effects of economic & sociopolitical changes (*medium confidence*, Major contribution from climate change) [18.4, 28.2, Tables 18-4 & 18-9]

Central & South America	
Snow & Ice, Rivers & Lakes, Floods & Drought	• Shrinkage of Andean glaciers (*high confidence*, Major contribution from climate change) • Changes in extreme flows in Amazon River (*medium confidence*, Major contribution from climate change) • Changing discharge patterns in rivers in the western Andes (*medium confidence*, Major contribution from climate change) • Increased streamflow in sub-basins of the La Plata River, beyond increase due to land use change (*high confidence*, Major contribution from climate change) [27.3, Tables 18-5, 18-6, & 27-3; WGI AR5 4.3]
Terrestrial Ecosystems	• Increased tree mortality & forest fire in the Amazon (*low confidence*, Minor contribution from climate change) • Rainforest degradation & recession in the Amazon, beyond reference trends in deforestation & land degradation (*low confidence*, Minor contribution from climate change) [4.3, 18.3, 27.2-3, Table 18-7]
Coastal Erosion & Marine Ecosystems	• Increased coral bleaching in western Caribbean, beyond effects from pollution & physical disturbance (*high confidence*, Major contribution from climate change) • Mangrove degradation on north coast of South America, beyond degradation due to pollution & land use (*low confidence*, Minor contribution from climate change) [27.3, Table 18-8]
Food Production & Livelihoods	• More vulnerable livelihood trajectories for indigenous Aymara farmers in Bolivia due to water shortage, beyond effects of increasing social & economic stress (*medium confidence*, Major contribution from climate change) • Increase in agricultural yields & expansion of agricultural areas in southeastern South America, beyond increase due to improved technology (*medium confidence*, Major contribution from climate change) [13.1, 27.3, Table 18-9]
Polar Regions	
Snow & Ice, Rivers & Lakes, Floods & Drought	• Decreasing Arctic sea ice cover in summer (*high confidence*, Major contribution from climate change) • Reduction in ice volume in Arctic glaciers (*high confidence*, Major contribution from climate change) • Decreasing snow cover extent across the Arctic (*medium confidence*, Major contribution from climate change) • Widespread permafrost degradation, especially in the southern Arctic (*high confidence*, Major contribution from climate change) • Ice mass loss along coastal Antarctica (*medium confidence*, Major contribution from climate change) • Increased river discharge for large circumpolar rivers (1997–2007) (*low confidence*, Major contribution from climate change) • Increased winter minimum river flow in most of the Arctic (*medium confidence*, Major contribution from climate change) • Increased lake water temperatures 1985–2009 & prolonged ice-free seasons (*medium confidence*, Major contribution from climate change) • Disappearance of thermokarst lakes due to permafrost degradation in the low Arctic. New lakes created in areas of formerly frozen peat (*high confidence*, Major contribution from climate change) [28.2, Tables 18-5 & 18-6; WGI AR5 4.2-4, 4.6, 10.5]
Terrestrial Ecosystems	• Increased shrub cover in tundra in North America & Eurasia (*high confidence*, Major contribution from climate change) • Advance of Arctic tree-line in latitude & altitude (*medium confidence*, Major contribution from climate change) • Changed breeding area & population size of subarctic birds, due to snowbed reduction &/or tundra shrub encroachment (*medium confidence*, Major contribution from climate change) • Loss of snow-bed ecosystems & tussock tundra (*high confidence*, Major contribution from climate change) • Impacts on tundra animals from increased ice layers in snow pack, following rain-on-snow events (*medium confidence*, Major contribution from climate change) • Increased plant species ranges in the West Antarctic Peninsula & nearby islands over the past 50 years (*high confidence*, Major contribution from climate change) • Increased phytoplankton productivity in Signy Island lake waters (*high confidence*, Major contribution from climate change) [28.2, Table 18-7]
Coastal Erosion & Marine Ecosystems	• Increased coastal erosion across Arctic (*medium confidence*, Major contribution from climate change) • Negative effects on non-migratory Arctic species (*high confidence*, Major contribution from climate change) • Decreased reproductive success in Arctic seabirds (*medium confidence*, Major contribution from climate change) • Decline in Southern Ocean seals & seabirds (*medium confidence*, Major contribution from climate change) • Reduced thickness of foraminiferal shells in southern oceans, due to ocean acidification (*medium confidence*, Major contribution from climate change) • Reduced krill density in Scotia Sea (*medium confidence*, Major contribution from climate change) [6.3, 18.3, 28.2-3, Table 18-8]
Food Production & Livelihoods	• Impact on livelihoods of Arctic indigenous peoples, beyond effects of economic & sociopolitical changes (*medium confidence*, Major contribution from climate change) • Increased shipping traffic across the Bering Strait (*medium confidence*, Major contribution from climate change) [18.4, 28.2, Tables 18-4 & 18-9, Figure 28-4]
Small Islands	
Snow & Ice, Rivers & Lakes, Floods & Drought	Increased water scarcity in Jamaica, beyond increase due to water use (*very low confidence*, Minor contribution from climate change) [Table 18-6]
Terrestrial Ecosystems	• Tropical bird population changes in Mauritius (*medium confidence*, Major contribution from climate change) • Decline of an endemic plant in Hawai'i (*medium confidence*, Major contribution from climate change) • Upward trend in tree-lines & associated fauna on high-elevation islands (*low confidence*, Minor contribution from climate change) [29.3, Table 18-7]
Coastal Erosion & Marine Ecosystems	• Increased coral bleaching near many tropical small islands, beyond effects of degradation due to fishing & pollution (*high confidence*, Major contribution from climate change) • Degradation of mangroves, wetlands, & seagrass around small islands, beyond degradation due to other disturbances (*very low confidence*, Minor contribution from climate change) • Increased flooding & erosion, beyond erosion due to human activities, natural erosion, & accretion (*low confidence*, Minor contribution from climate change) • Degradation of groundwater & freshwater ecosystems due to saline intrusion, beyond degradation due to pollution & groundwater pumping (*low confidence*, Minor contribution from climate change) [29.3, Table 18-8]
Food Production & Livelihoods	Increased degradation of coastal fisheries due to direct effects & effects of increased coral reef bleaching, beyond degradation due to overfishing & pollution (*low confidence*, Minor contribution from climate change) [18.3-4, 29.3, 30.6, Table 18-9, Box CC-CR]

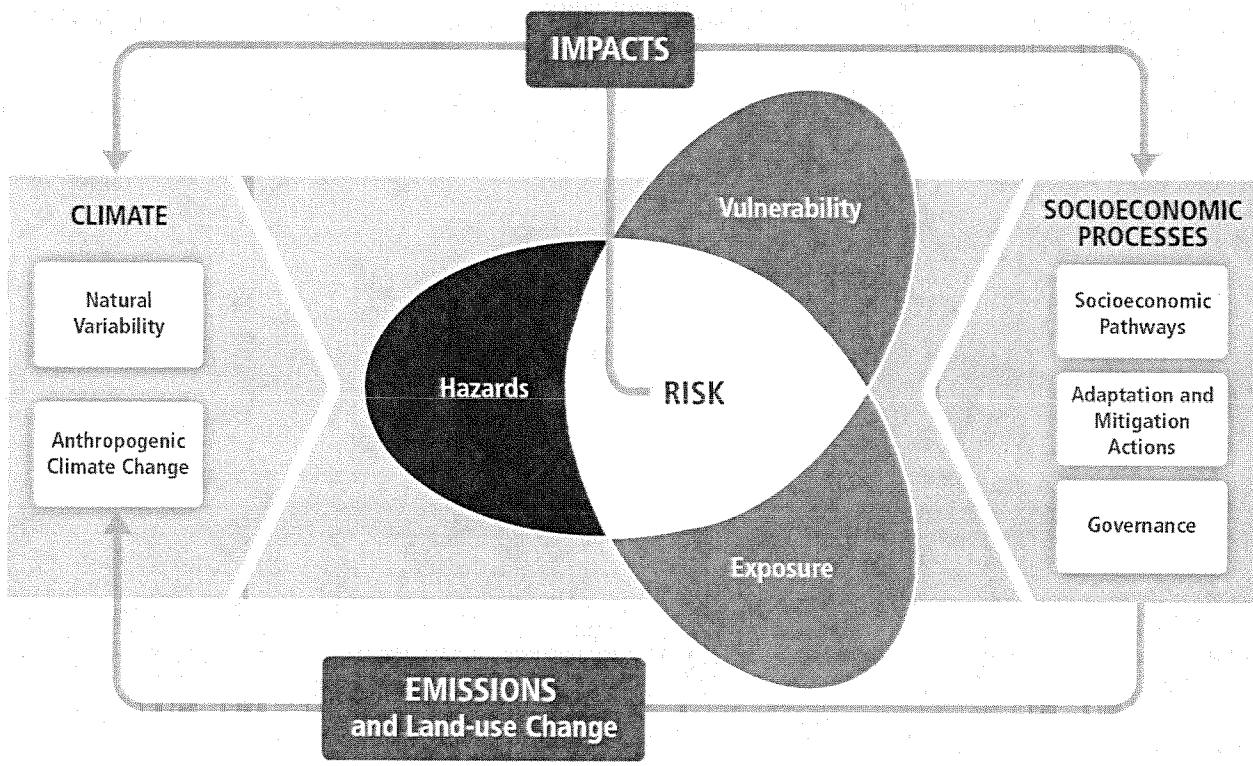

IMPACTS
CLIMATE
Natural Variability
Anthropogenic Climate Change
Hazards
Vulnerability
RISK
Exposure
SOCIOECONOMIC PROCESSES
Socioeconomic Pathways
Adaptation and Mitigation Actions
Governance
EMISSIONS and Land-use Change

Figure SPM.1.

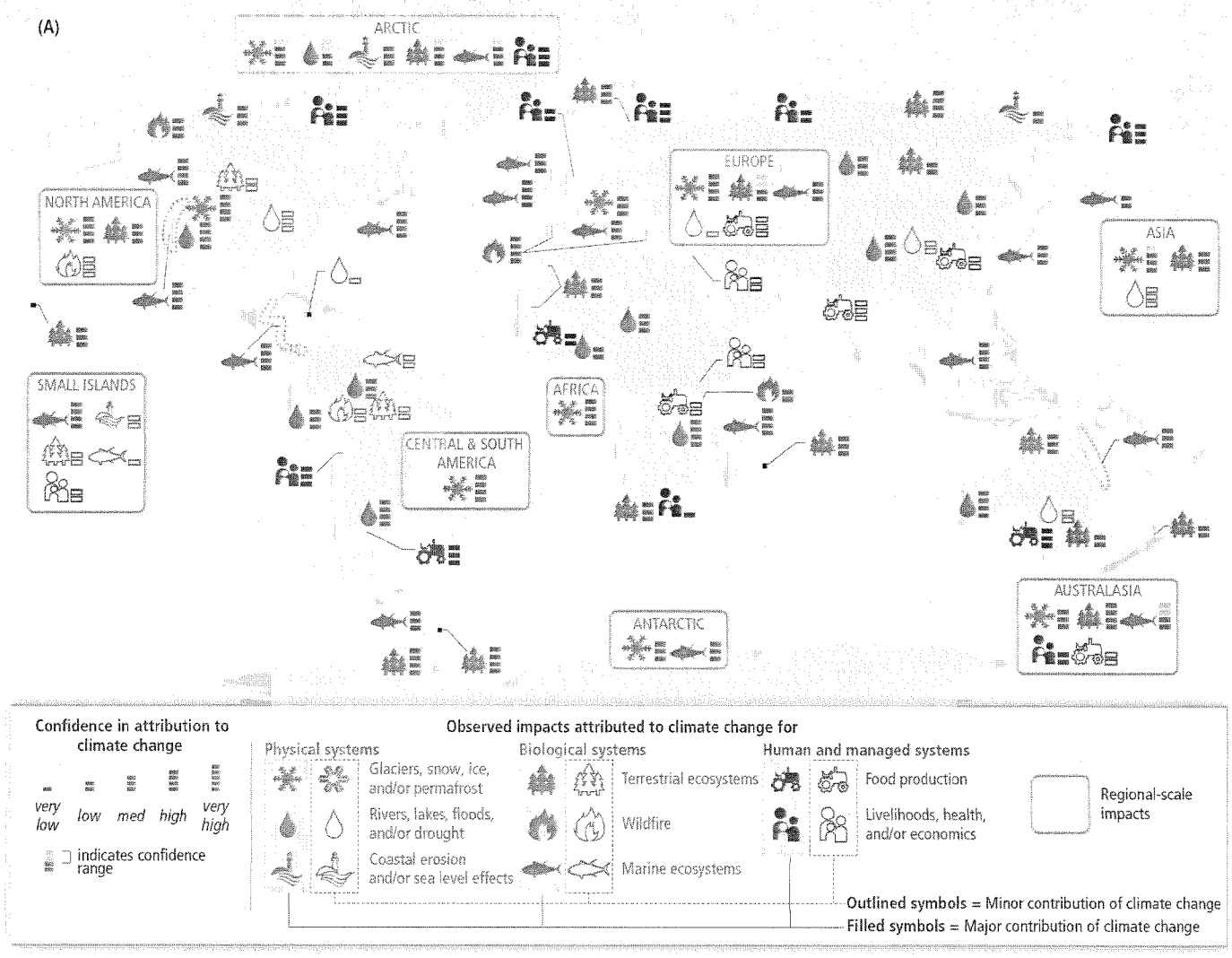

(A)
ARCTIC
NORTH AMERICA
EUROPE
ASIA
SMALL ISLANDS
AFRICA
CENTRAL & SOUTH AMERICA
AUSTRALASIA
ANTARCTIC
Confidence in attribution to climate change
very low
low
med
high
very high
indicates confidence range
Observed impacts attributed to climate change for
Physical systems
Biological systems
Human and managed systems
Glaciers, snow, ice, and/or permafrost
Rivers, lakes, floods, and/or drought
Coastal erosion and/or sea level effects
Terrestrial ecosystems
Wildfire
Marine ecosystems
Food production
Livelihoods, health, and/or economics
Regional-scale impacts
Outlined symbols = Minor contribution of climate change
Filled symbols = Major contribution of climate change
(B)
Distribution change (km per decade)
400
100
20
0
−20
Cooler
Warmer
Standard error
Mean
Standard error
(90)
(20)
(46)
(29)
(9)
(3)
(13)
(29)
(9)
(111)
(359)
Benthic algae
Benthic cnidarians
Benthic molluscs
Benthic crustacea
Benthic invert. (other)
Phytoplankton
Zooplankton
Larval bony fishes
Non-bony fishes
Bony fishes
All taxa
(C)
Yield impact (% change per decade)
2
0
−2
−4
−6
(19)
(27)
(18)
(10)
(13)
(12)
90th percentile
75th percentile
Median
25th percentile
10th percentile
Tropical
Temperate
Region
Wheat
Soy
Rice
Maize
Crop type

Figure SPM.2.

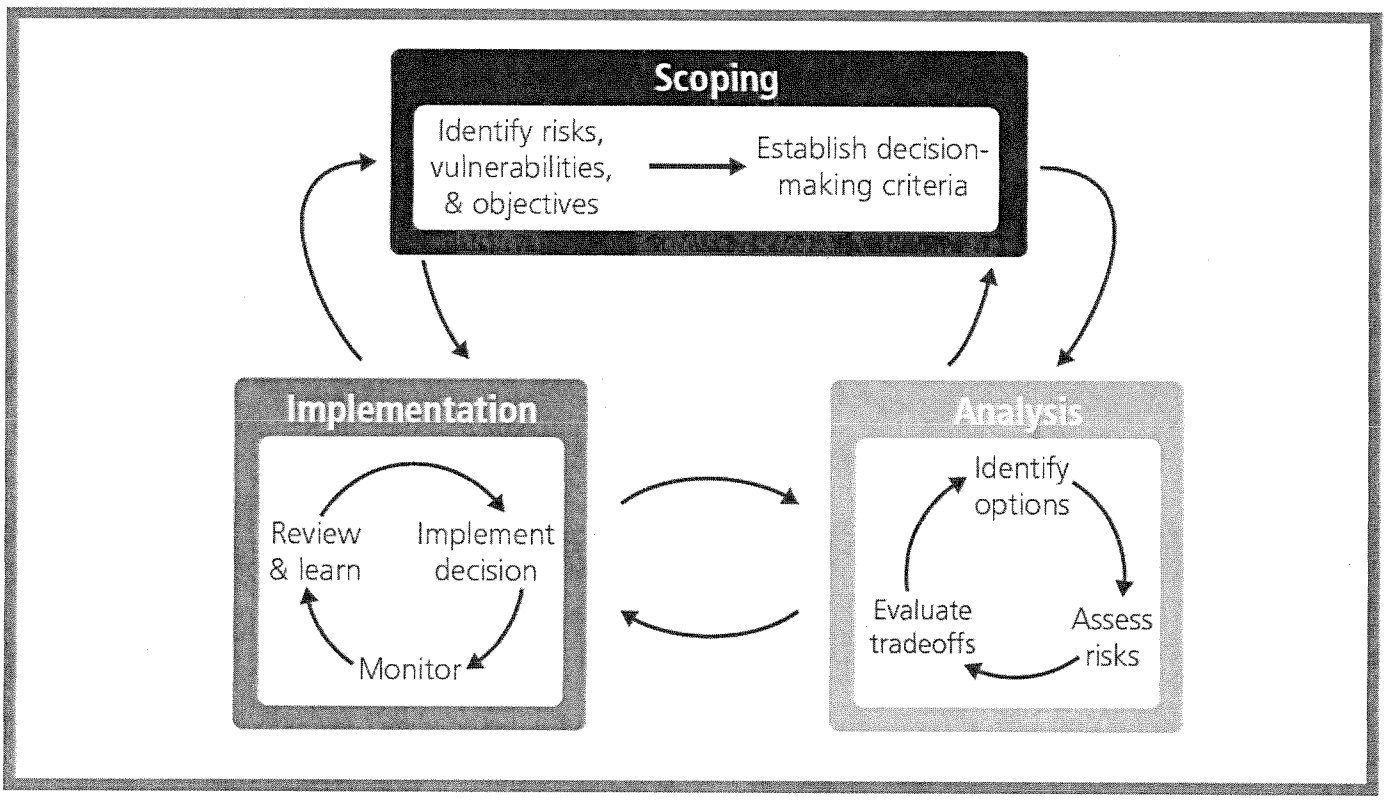

Scoping
Identify risks, vulnerabilities, & objectives
Establish decision-making criteria
Implementation
Review & learn
Implement decision
Monitor
Analysis
Identify options
Assess risks
Evaluate tradeoffs

Figure SPM.3.

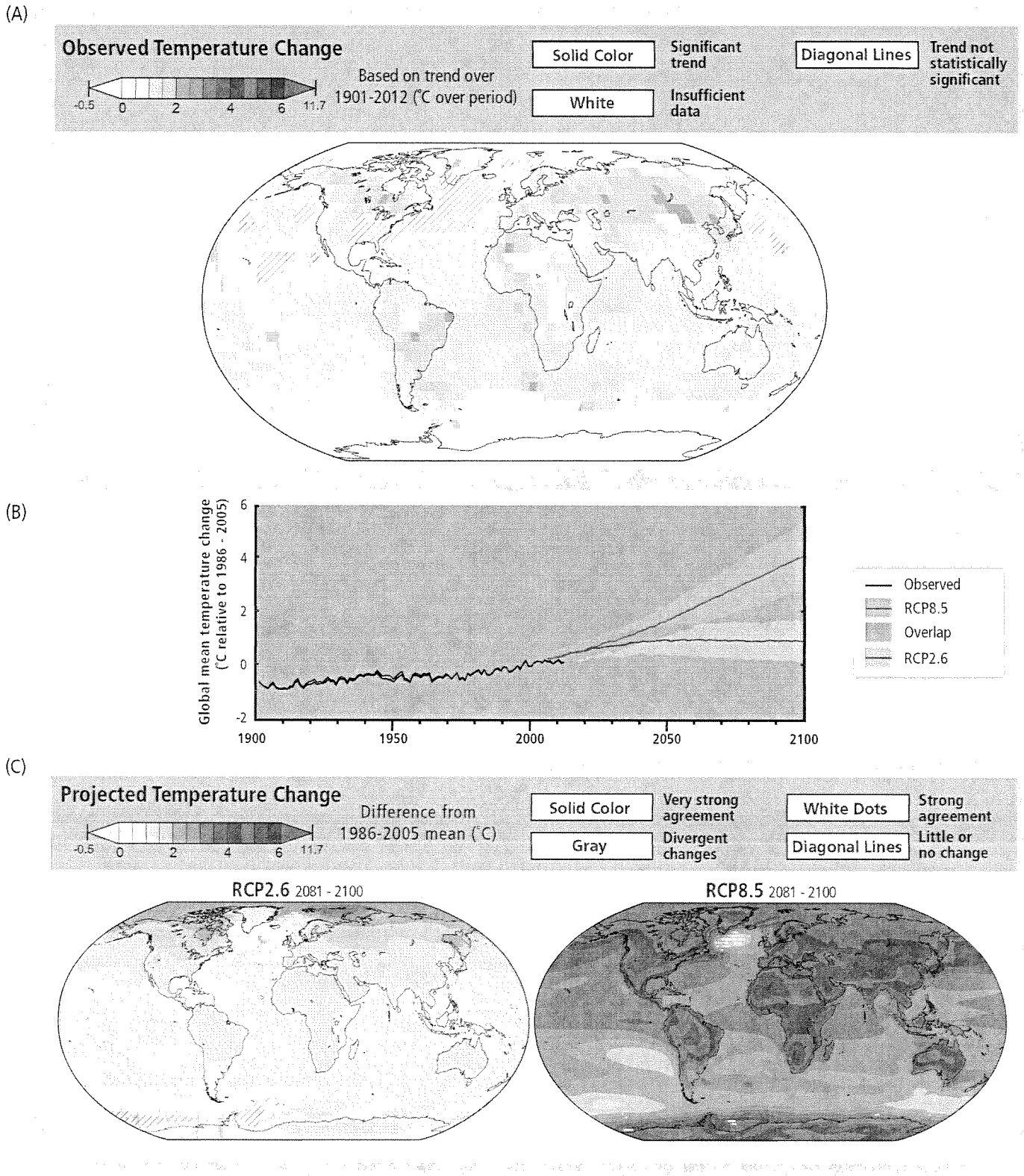
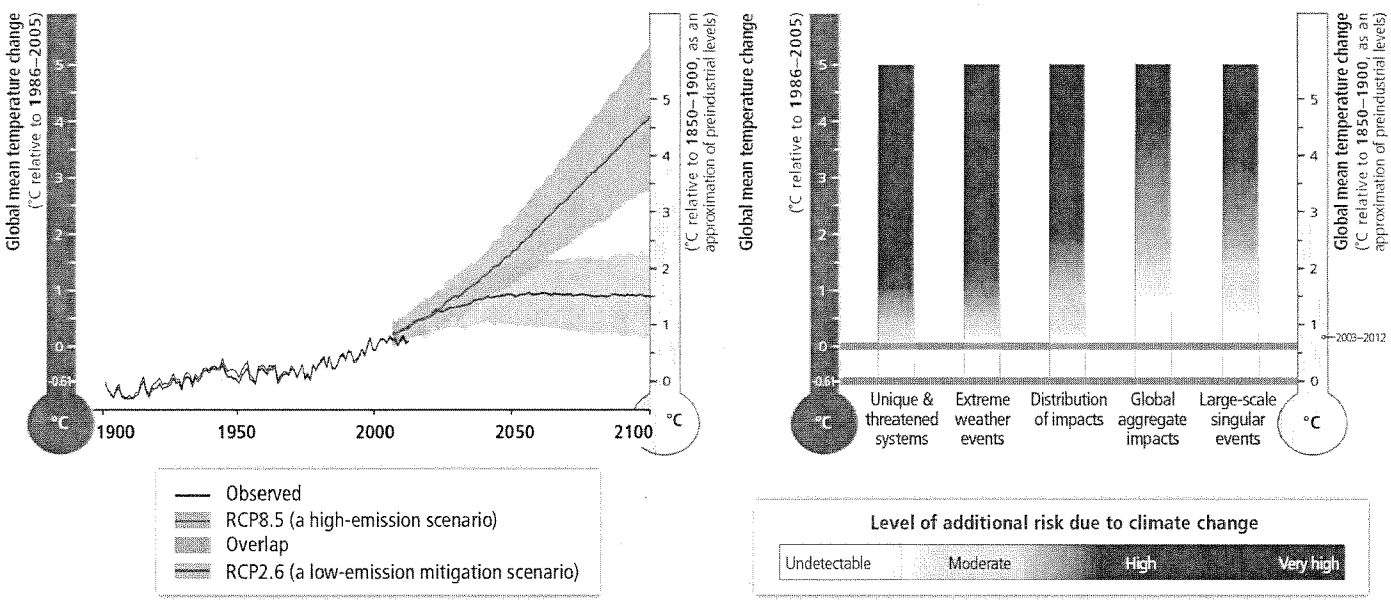

(A)
Observed Temperature Change
-0.5 0 2 4 6 11.7
Based on trend over 1901-2012 (°C over period)
Solid Color
Significant trend
White
Insufficient data
Diagonal Lines
Trend not statistically significant
(B)
Global mean temperature change (°C relative to 1986 - 2005)
6
4
2
0
-2
1900
1950
2000
2050
2100
Observed
RCP8.5
Overlap
RCP2.6
(C)
Projected Temperature Change
-0.5 0 2 4 6 11.7
Difference from 1986-2005 mean (°C)
Solid Color
Very strong agreement
Gray
Divergent changes
White Dots
Strong agreement
Diagonal Lines
Little or no change
RCP2.6 2081 - 2100
RCP8.5 2081 - 2100

Figure SPM.4.



Assessment Box SPM.1 Figure 1.

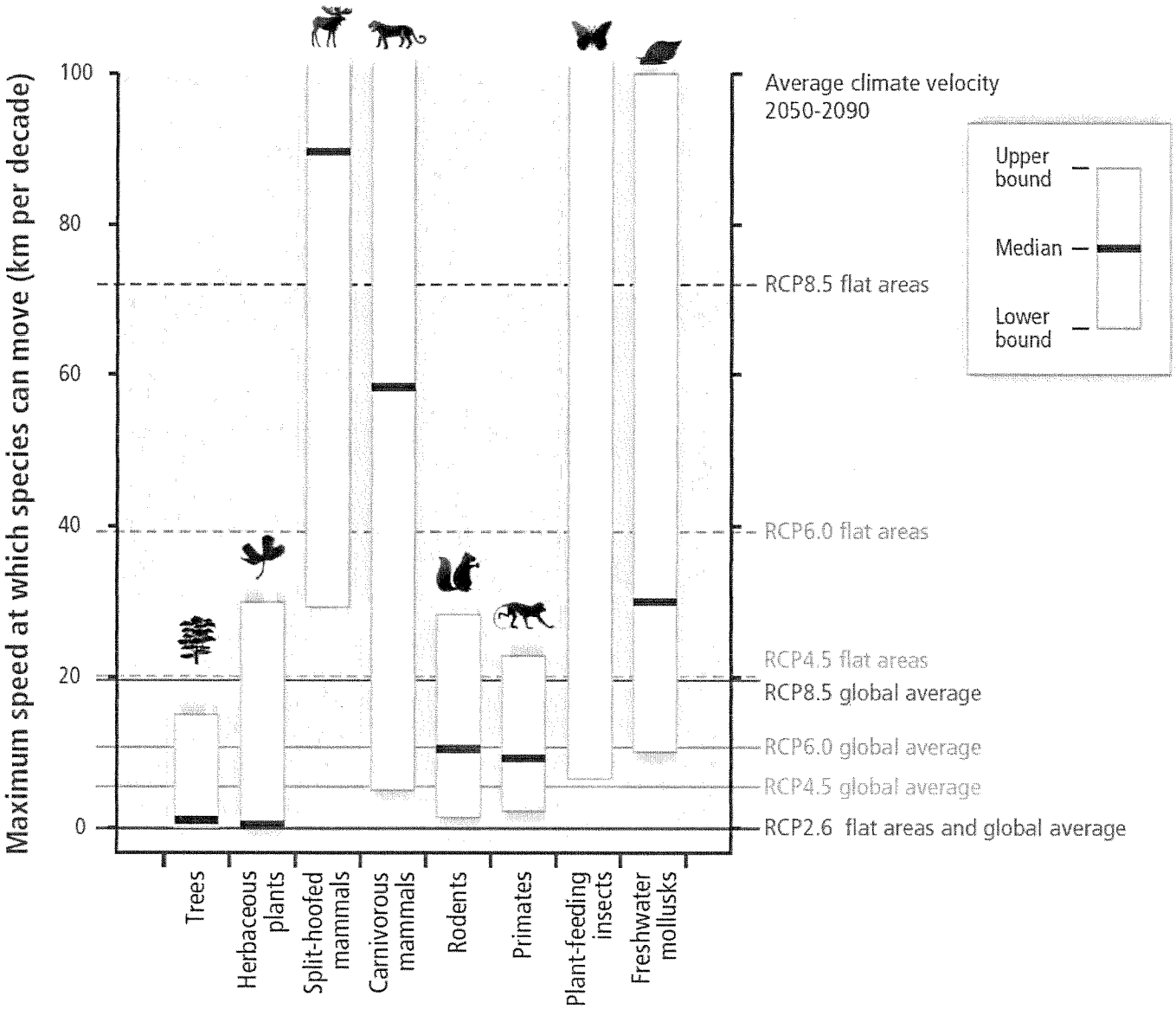

Maximum speed at which species can move (km per decade)
100
80
60
40
20
0
Average climate velocity 2050-2090
Upper bound
Median
Lower bound
RCP8.5 flat areas
RCP6.0 flat areas
RCP4.5 flat areas
RCP8.5 global average
RCP6.0 global average
RCP4.5 global average
RCP2.6 flat areas and global average
Trees
Herbaceous plants
Split-hoofed mammals
Carnivorous mammals
Rodents
Primates
Plant-feeding insects
Freshwater mollusks

Figure SPM.5.

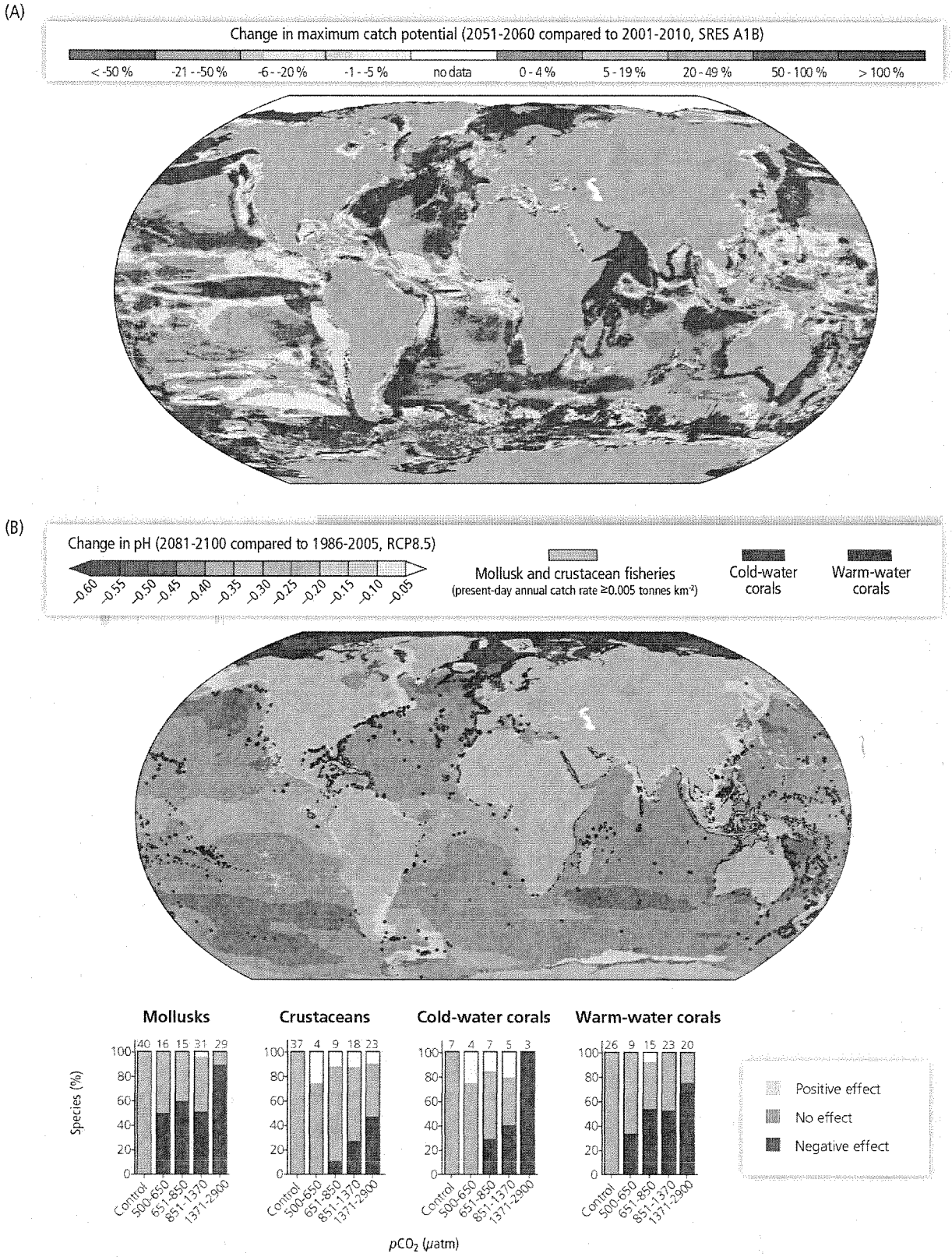

(A)
Change in maximum catch potential (2051-2060 compared to 2001-2010, SRES A1B)
< -50 %
-21 - -50 %
-6 - -20 %
-1 - -5 %
no data
0 - 4 %
5 - 19 %
20 - 49 %
50 - 100 %
> 100 %
(B)
Change in pH (2081-2100 compared to 1986-2005, RCP8.5)
-0.60 -0.55 -0.50 -0.45 -0.40 -0.35 -0.30 -0.25 -0.20 -0.15 -0.10 -0.05
Mollusk and crustacean fisheries
(present-day annual catch rate ≥0.005 tonnes km-2)
Cold-water corals
Warm-water corals
Mollusks
Crustaceans
Cold-water corals
Warm-water corals
Species (%)
40 16 15 31 29
37 4 9 18 23
7 4 7 5 3
26 9 15 23 20
Control
500-650
651-850
851-1370
1371-2900
Positive effect
No effect
Negative effect
pCO2 (µatm)

Figure SPM.6.

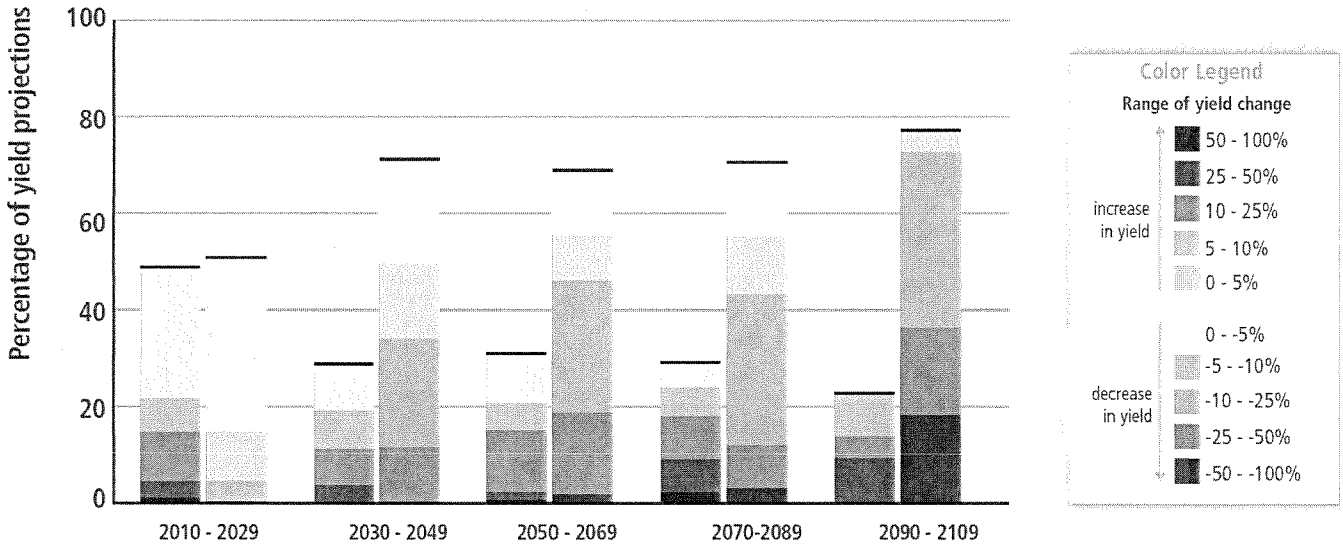

Percentage of yield projections
100
80
60
40
20
0
2010 - 2029
2030 - 2049
2050 - 2069
2070-2089
2090 - 2109
Color Legend
Range of yield change
increase in yield
50 - 100%
25 - 50%
10 - 25%
5 - 10%
0 - 5%
decrease in yield
0 - -5%
-5 - -10%
-10 - -25%
-25 - -50%
-50 - -100%

Figure SPM.7.

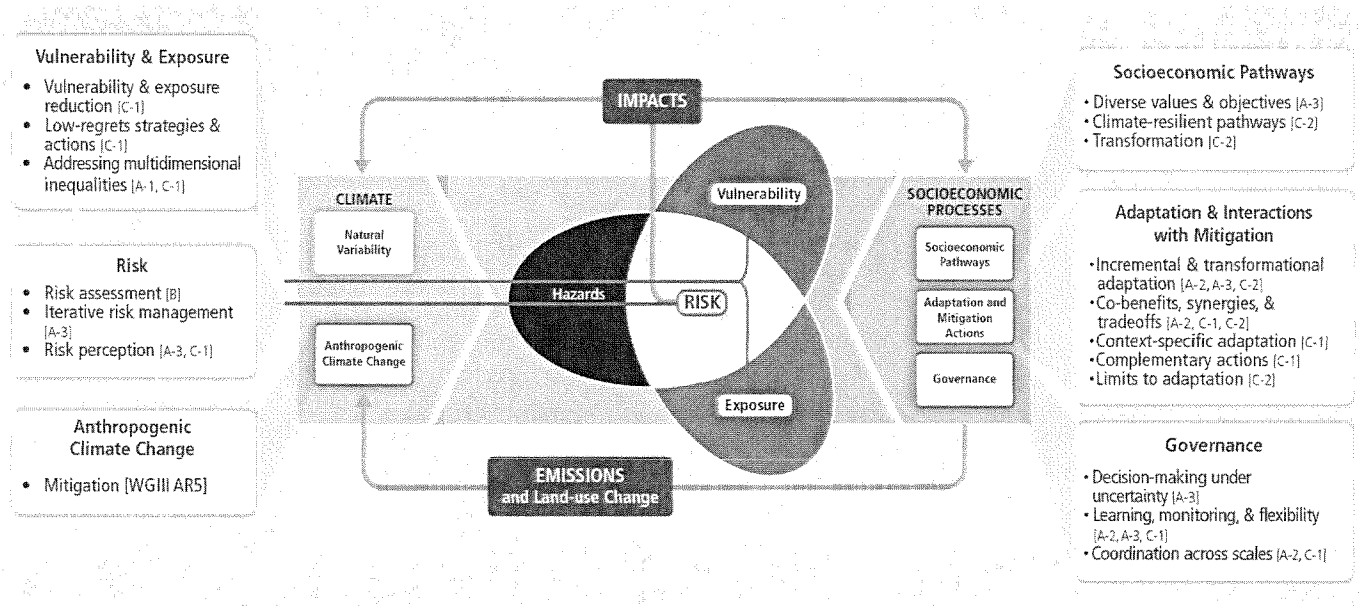

Vulnerability & Exposure
• Vulnerability & exposure reduction [C-1]
• Low-regrets strategies & actions [C-1]
• Addressing multidimensional inequalities [A-1, C-1]
Risk
• Risk assessment [B]
• Iterative risk management [A-3]
• Risk perception [A-3, C-1]
Anthropogenic Climate Change
• Mitigation [WGIII AR5]
IMPACTS
CLIMATE
Natural Variability
Anthropogenic Climate Change
Hazards
Vulnerability
RISK
Exposure
SOCIOECONOMIC PROCESSES
Socioeconomic Pathways
Adaptation and Mitigation Actions
Governance
EMISSIONS and Land-use Change
Socioeconomic Pathways
• Diverse values & objectives [A-3]
• Climate-resilient pathways [C-2]
• Transformation [C-2]
Adaptation & Interactions with Mitigation
• Incremental & transformational adaptation [A-2, A-3, C-2]
• Co-benefits, synergies, & tradeoffs [A-2, C-1, C-2]
• Context-specific adaptation [C-1]
• Complementary actions [C-1]
• Limits to adaptation [C-2]
Governance
• Decision-making under uncertainty [A-3]
• Learning, monitoring, & flexibility [A-2, A-3, C-1]
• Coordination across scales [A-2, C-1]

Figure SPM.8.

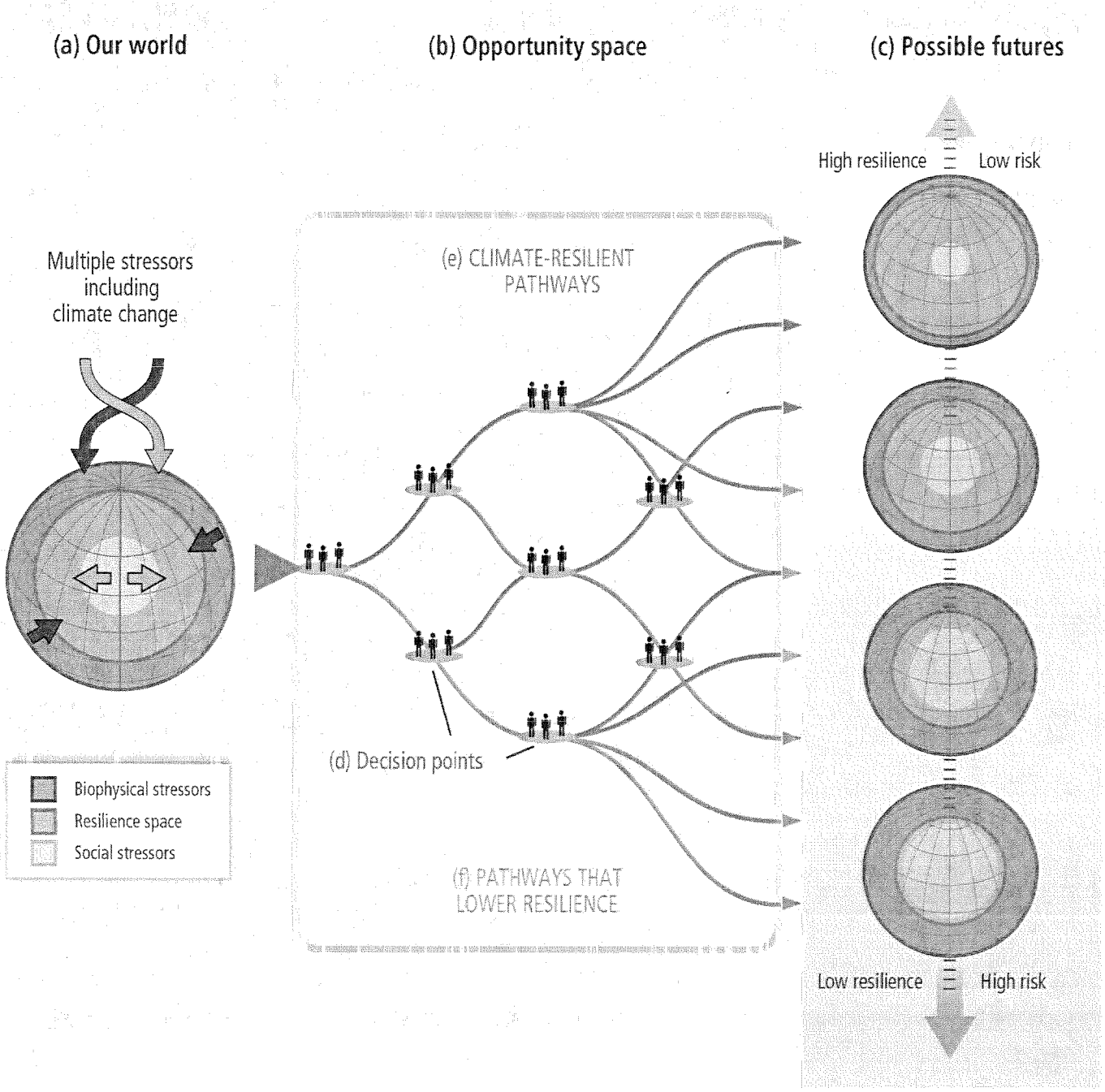

(a) Our world
(b) Opportunity space
(c) Possible futures
High resilience
Low risk
Multiple stressors including climate change
(e) CLIMATE-RESILIENT PATHWAYS
(d) Decision points
(f) PATHWAYS THAT LOWER RESILIENCE
Biophysical stressors
Resilience space
Social stressors
Low resilience
High risk

Figure SPM.9.

From: Howard Itow <pufferfish7@yahoo.com>
Sent: Tuesday, July 29, 2014 11:19 PM
To: BDCP.Comments@noaa.gov
Subject: BDCP Public Comment
Attachments: BDCP Comment Letter SENT VIA EMAIL.doc

BDCP Comments
Ryan Wulff, National Marine Fisheries Service
650 Capitol Mall, Suite 5-100
Sacramento, CA 95814

Dear Mr. Wulff:

Attached my comments regarding the BDCP.

Thank you,

Howard Itow

SENT VIA EMAIL

BDCP 1753

July 29, 2014

BDCP Comments
Ryan Wulff, National Marine Fisheries Service
650 Capitol Mall, Suite 5-100
Sacramento, CA 95814

Dear Mr. Wulff:

While the BDCP was originally intended to meet the co-equal goals of restoring the vital Bay-Delta ecosystem and improving water supply reliability, it is my opinion that the current proposal fails to do either.

The proposed BDCP ignores the overwhelming scientific evidence that we must INCREASE the amount of water flowing through the Delta to restore it to health. The BDCP, instead, focuses on diverting away even more river water than what is already diverted annually.

For the sake of expediency, I will drill down to a few points.

I object to the Conservation Measure 15 (CM 15). CM15 threatens the entire Delta Community, not just the fishery. An entire community of marinas, restaurants, groceries/gas retailers, service repair shops, and fishing/boating retail/services plus the economy that goes beyond the immediate area of the Delta would be severely affected by the eradication of Striped Bass.

The BDCP apparently needs to be reminded that Striped Bass have made the delta its home for over 130 years. Lives, family legacies, and a way of life for so many multi-generational California families revolve around the 130 years of the California Delta Striped Bass, which IS a California natural resource that is to be managed and protected, not eradicated.

A word about the take permits. Before take permits can be issued under a habitat conservation plan, funding must be shown to be sufficient for all proposed activities, and all financial contributors and planned allocation of funds must be identified.

In short, from what I've gleaned from various substantiated publications the past several months, no one, including the agricultural and urban beneficiaries of the tunnels, wants to pay for this ill-conceived infrastructure project, so I encourage the fisheries agencies to refuse to issue permits that would enable it to go forward.

In summary, the San Francisco Bay/Sacramento/San Joaquin Delta is a mere shadow of its former self due to decades-long mismanaged water diversion practices. The BDCP focuses on diverting even more river water; therefore, it is a plan that cannot possibly restore the delta to a healthy ecosystem.

Respectfully submitted,

Howard Itow
3700 Jennieke Ct.
Rocklin, CA 95765

Bay Delta Conservation Plan (BDCP) and Associated Draft Environmental Impact Report (EIR)/ Environmental Impact Statement (EIS) Comment

Name: Barbara Daly

Organization: North Delta C.A.R.E.S.

Date: July 27, 2014

Address: P.O. Box 255 (Address) Clarksburg (City) California (State) 95612 (Zip Code)

Alternative 4—Dual Conveyance with Modified Pipeline/Tunnel 15 and Intakes 2, 3, and 5 (9,000 cfs; Operational Scenario H) (16.3.3.9)

Alternative 4 would result in temporary effects on lands and communities associated with construction of three intakes and intake pumping plants, and other associated facilities; an intermediate forebay; conveyance pipelines; tunnels; an operable barrier at the head of Old River, and a new 600 acre Byron Tract Forebay, adjacent to and south of Clifton Court Forebay. Nearby areas would be altered as work or staging areas, concrete batch plants, fuel stations, or be used for spoils storage areas. Transmission lines, access roads, and other incidental facilities would also be needed for operations, and construction of these structures would also have effects on lands and communities.

Document: EIR/EIS

Chapter: 16 – Socioeconomics

Key Quote/Potential Impact:

EIR/EIS Impact Statement Executive Summary, Page ES-115

"Impact ECON-1: Temporary Effects on Regional Economics and Employment in the Delta Region during Construction of the Proposed Water Conveyance Facilities"

COMMENT 3:

Alternative 4:Using IMPLAN for modeling is misleading because it cannot correctly identify the recreation components that need to be used to make educated decisions on economic impacts in the Sacramento-San Joaquin River Delta due to the water conveyance construction. IMPLAN is being used for the regional economic and employment data to inform the EIR/EIS; and per Jeffrey Michael, Professor at Eberhardt School of Business, "It is worth noting that there are well-

known problems with applying a static input-output model such as IMPLAN to the types of long-run macroeconomic effects considered in this section of the Report . . ."(2) Either IMPLAN should be reconfigured to adequately model the full economic impacts of the Delta, including the full scope of recreation, or another model needs to be designed and implemented.

IMPACTS NOT CORRECT OR NOT IDENTIFIED and IMPACT DESIGNATIONS:

- Loss of recreation expenditures is not in the IMPLAN which accounts for inter-county spending patterns.
- All impacts are Adverse/Significant and Unavoidable

MITIGATION:

- There is no mitigation for loss of recreational expenditures in the Sacramento-San Joaquin River Delta including as noted in above Comment 3.
- There needs to be an assessment of the total number of jobs lost due to loss of recreation-oriented activities in the Delta and the number needs to be compared to the number of permanent positions provided by the BDCP (190).

STUDIES/PAPERS/REFERENCES/DOCUMENTATION, ETC.:

(1) The Brattle Group's Paper "Employment Impacts for Proposed Bay Delta Water Conveyance Facility and Habitat Restoration", February 22, 2013, www.brattle.com.

(2) "Review of the Bay Delta Conservation Plan Statewide Economic Impact Report, August 2013 draft," Page 14; Dr. Jeffrey Michael, Director, Business Forecasting Center, Eberhardt School of Business, University of the Pacific, December 2013.

BDCP 1754

Bay Delta Conservation Plan (BDCP) and Associated Draft Environmental Impact Report (EIR)/ Environmental Impact Statement (EIS) Comment

Name: Barbara Daly

Organization: North Delta C.A.R.E.S.

Date: July 27, 2014

Address:

P.O. Box 255	Clarksburg	California	95612
(Address)	(City)	(State)	(Zip Code)

Document: EIR/EIS

Alternative 4—Dual Conveyance with Modified Pipeline/Tunnel 15 and Intakes 2, 3, and 5 (9,000 cfs; Operational Scenario H) (16.3.3.9)

Alternative 4 would result in temporary effects on lands and communities associated with construction of three intakes and intake pumping plants, and other associated facilities; an intermediate forebay; conveyance pipelines; tunnels; an operable barrier at the head of Old River, and a new 600 acre Byron Tract Forebay, adjacent to and south of Clifton Court Forebay. Nearby areas would be altered as work or staging areas, concrete batch plants, fuel stations, or be used for spoils storage areas. Transmission lines, access roads, and other incidental facilities would also be needed for operations, and construction of these structures would also have effects on lands and communities.

Chapter: 16 - Socioeconomics

Key Quote/Potential Impact:

EIS/EIR Impact Statement Executive Summary, Page ES-115

"Impact ECON-1: Temporary Effects on Regional Economics and Employment in the Delta Region during Construction of the Proposed Water Conveyance Facilities"

COMMENT 4:

Alternative 4: The proposed mitigation for Agricultural employment losses is inadequate as the 190 operations and maintenance permanent jobs provided by the BDCP (EIR/EIS Page 30-43, L 29-30) in the Sacramento – San Joaquin Delta Counties is grossly insufficient to replace the significant permanent agriculture employment currently existing in the Delta. Per Table 16-8 (EIR/EIS Page 16-16) agriculture employment in 2011 was 25,100.

BDCP 1754

SUPPORTING INFORMATION/ASSESSMENT/MITIGATION MEASURE(S):

The Brattle Group Document(1), Page 3: "When interpreting our results, it is important to note that the project generates most jobs during the early phase of the Plan, while job losses from agricultural land retirement increase over time as the amount of retired land increases as a consequence of restoration. The time pattern of gains and losses is significant in that we have much more confidence in the near-term job estimates than in those forecasted decades in to the future."

IMPACTS NOT CORRECT OR NOT IDENTIFIED and IMPACT DESIGNATIONS:

- Loss of recreation employment is not in the IMPLAN which accounts for inter-county spending patterns.
- All impacts are Adverse.

MITIGATION:

- There is no mitigation for loss of recreational income in the Sacramento – San Joaquin River Delta including as noted in above Comment 1.
- There needs to be an assessment of the total number of jobs lost due to loss of recreation-oriented activities in the Delta and the number needs to be compared to the number of permanent positions provided by the BDCP (190).
- Mitigation for loss of agricultural jobs and income is inadequate, as the tunnel will not replace the $130 million crop value that the estimated loss of 100,000 acres would accrue yearly. This is based on the estimated $650 million crop value for 480,000 acres of Delta irrigated acres (EIR/EIS Page 16-51, L 24-25).

STUDIES/PAPERS/REFERENCES/DOCUMENTATION, ETC.:

(1) The Brattle Group's Paper "Employment Impacts for Proposed Bay Delta Water Conveyance Facility and Habitat Restoration," February 22, 2013, www.brattle.com.

(2) "Review of the Bay Delta conservation Plan Statewide Economic Impact Report, August 2013 draft," Page 14; Dr. Jeffrey Michael, Director, Business Forecasting Center, Eberhardt School of Business, University of the Pacific, December 2013.

BDCP 1754

Bay Delta Conservation Plan (BDCP) and Associated Draft Environmental Impact Report (EIR)/ Environmental Impact Statement (EIS) Comment

Name: Barbara Daly

Organization: North Delta C.A.R.E.S.

Date: July 27, 2014

Address: P.O. Box 255 (Address) Clarksburg (City) California (State) 95612 (Zip Code)

Alternative 4—Dual Conveyance with Modified Pipeline/Tunnel 15 and Intakes 2, 3, and 5 (9,000 cfs; Operational Scenario H) (16.3.3.9)

Alternative 4 would result in temporary effects on lands and communities associated with construction of three intakes and intake pumping plants, and other associated facilities; an intermediate forebay; conveyance pipelines; tunnels; an operable barrier at the head of Old River, and a new 600 acre Byron Tract Forebay, adjacent to and south of Clifton Court Forebay. Nearby areas would be altered as work or staging areas, concrete batch plants, fuel stations, or be used for spoils storage areas. Transmission lines, access roads, and other incidental facilities would also be needed for operations, and construction of these structures would also have effects on lands and communities.

Document: EIR/EIS

Chapter: 16 – Socioeconomics

Key Quote/Potential Impact:

EIR/EIS Impact Statement Executive Summary, Page ES-115

"Impact ECON-1: Temporary Effects on Regional Economics and Employment in the Delta Region during Construction of the Proposed Water Conveyance Facilities"

COMMENT 3:

Alternative 4:Using IMPLAN for modeling is misleading because it cannot correctly identify the recreation components that need to be used to make educated decisions on economic impacts in the Sacramento-San Joaquin River Delta due to the water conveyance construction. IMPLAN is being used for the regional economic and employment data to inform the EIR/EIS; and per Jeffrey Michael, Professor at Eberhardt School of Business, "It is worth noting that there are well-

known problems with applying a static input-output model such as IMPLAN to the types of long-run macroeconomic effects considered in this section of the Report . . ."(2) Either IMPLAN should be reconfigured to adequately model the full economic impacts of the Delta, including the full scope of recreation, or another model needs to be designed and implemented.

IMPACTS NOT CORRECT OR NOT IDENTIFIED and IMPACT DESIGNATIONS:

- Loss of recreation expenditures is not in the IMPLAN which accounts for inter-county spending patterns.
- All impacts are Adverse/Significant and Unavoidable

MITIGATION:

- There is no mitigation for loss of recreational expenditures in the Sacramento-San Joaquin River Delta including as noted in above Comment 3.
- There needs to be an assessment of the total number of jobs lost due to loss of recreation-oriented activities in the Delta and the number needs to be compared to the number of permanent positions provided by the BDCP (190).

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(1) The Brattle Group's Paper "Employment Impacts for Proposed Bay Delta Water Conveyance Facility and Habitat Restoration", February 22, 2013, www.brattle.com.

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EIS/EIR Impact Statement Executive Summary, Page ES-115

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COMMENT 4:

Alternative 4: The proposed mitigation for Agricultural employment losses is inadequate as the 190 operations and maintenance permanent jobs provided by the BDCP (EIR/EIS Page 30-43, L 29-30) in the Sacramento – San Joaquin Delta Counties is grossly insufficient to replace the significant permanent agriculture employment currently existing in the Delta. Per Table 16-8 (EIR/EIS Page 16-16) agriculture employment in 2011 was 25,100.

BDCP 1754

SUPPORTING INFORMATION/ASSESSMENT/MITIGATION MEASURE(S):

The Brattle Group Document(1), Page 3: "When interpreting our results, it is important to note that the project generates most jobs during the early phase of the Plan, while job losses from agricultural land retirement increase over time as the amount of retired land increases as a consequence of restoration. The time pattern of gains and losses is significant in that we have much more confidence in the near-term job estimates than in those forecasted decades in to the future."

IMPACTS NOT CORRECT OR NOT IDENTIFIED and IMPACT DESIGNATIONS:

- Loss of recreation employment is not in the IMPLAN which accounts for inter-county spending patterns.
- All impacts are Adverse.

MITIGATION:

- There is no mitigation for loss of recreational income in the Sacramento – San Joaquin River Delta including as noted in above Comment 1.
- There needs to be an assessment of the total number of jobs lost due to loss of recreation-oriented activities in the Delta and the number needs to be compared to the number of permanent positions provided by the BDCP (190).
- Mitigation for loss of agricultural jobs and income is inadequate, as the tunnel will not replace the $130 million crop value that the estimated loss of 100,000 acres would accrue yearly. This is based on the estimated $650 million crop value for 480,000 acres of Delta irrigated acres (EIR/EIS Page 16-51, L 24-25).

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Document: EIR/EIS

Chapter: 16 - Socioeconomics

Key Quote/Potential Impact:

EIS/EIR Impact Statement Executive Summary, Page ES-115

"Impact ECON-1: Temporary Effects on Regional Economics and Employment in the Delta Region during Construction of the Proposed Water Conveyance Facilities"

COMMENT 2:

Alternative 4: The dewatering needed to construct the intake facilities and tunnels for Alternative 4 will create significant adverse impacts on the marinas throughout the Sacramento – San Joaquin Delta. Lack of consistent and ample water flows through the Delta will conceivably strand and/or landlock at least some, if not all, the marinas in the Delta. This holds true also with the boats and other watercraft which may be using the marinas and waterways. A study needs to be performed to analyze the impacts to the marinas and other water-based recreational businesses to

determine the economic impacts. There would be approximately 10 marinas directly impacted which would be in the vicinity of the construction of the intake facilities and tunnels near Clarksburg and Walnut Grove. This would be a significant adverse impact.

A map of the Sacramento River waterways and corresponding water levels throughout the Delta show that there is rarely an average flow that exceeds 20' in depth throughout the entire Sacramento River through the Delta. Dewatering for construction would leave little or no water in the river for recreation.

SUPPORTING INFORMATION/ASSESSMENT/MITIGATION MEASURE(S):

EIR/EIS Page 14-121, L 26-28: "Localized effects related to dewatering activities in the vicinity of intake pump stations and the expanded Clifton Court Forebay would temporarily lower groundwater levels by up to 10 feet and 20 feet, respectively."

EIR/EIS Page 16-22, L 5-6: "The Delta recreation-related industries contribute about $5.8 billion in annual revenues, or about 9% of revenues for all industries . . ." EIR/EIS Page 16-22, L 26-27: "As shown in Table 16-12, boating activity accounts for the largest share of total recreation-related economic contributions in the Delta." As described in the above quotes, the loss of marinas and subsequent boating recreation, will have a significant adverse impact on the recreation economy of the Delta region. Because of the importance of the recreation economy to the total economic picture of the Delta, the lack of a definitive study on the recreation economy and lack of sufficient inclusion of this data in economic studies of the Delta makes all other data incorrect and thus irrelevant. The EIR/EIS BDCP document is not viable without conclusive information.

IMPACTS NOT CORRECT OR NOT IDENTIFIED and IMPACT DESIGNATIONS:

- The total effects of dewatering, including the economic impacts to boating recreation have not been studied or included in the EIR/EIS. We request further study of these impacts and how they will relate to the socioeconomic conditions in the Delta.
- All impacts are Adverse/Significant and Unavoidable.

MITIGATION:

- There is no mitigation for loss of recreational income in the Sacramento – San Joaquin Delta for boating recreation due to low water levels from dewatering.
- There needs to be an assessment of the total number of jobs lost due to loss of recreation-oriented activities in the Sacramento – San Joaquin Delta and the number needs to be compared to the number of permanent positions provided by the BDCP (190).

STUDIES/PAPERS/REFERENCES/DOCUMENTATION, ETC.:

(3) Map: The Delta – Suisun Bay, Sacramento & San Joaquin Rivers – Fish and Map Co. shows river depth information.

BDCP n54

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Document: EIR/EIS

Chapter: 16 - Socioeconomics

Key Quote/Potential Impact:

EIS/EIR Impact Statement Executive Summary, Page ES-115

"Impact ECON-1: Temporary Effects on Regional Economics and Employment in the Delta Region during Construction of the Proposed Water Conveyance Facilities"

COMMENT 2:

Alternative 4: The dewatering needed to construct the intake facilities and tunnels for Alternative 4 will create significant adverse impacts on the marinas throughout the Sacramento – San Joaquin Delta. Lack of consistent and ample water flows through the Delta will conceivably strand and/or landlock at least some, if not all, the marinas in the Delta. This holds true also with the boats and other watercraft which may be using the marinas and waterways. A study needs to be performed to analyze the impacts to the marinas and other water-based recreational businesses to

determine the economic impacts. There would be approximately 10 marinas directly impacted which would be in the vicinity of the construction of the intake facilities and tunnels near Clarksburg and Walnut Grove. This would be a significant adverse impact.

A map of the Sacramento River waterways and corresponding water levels throughout the Delta show that there is rarely an average flow that exceeds 20' in depth throughout the entire Sacramento River through the Delta. Dewatering for construction would leave little or no water in the river for recreation.

SUPPORTING INFORMATION/ASSESSMENT/MITIGATION MEASURE(S):

EIR/EIS Page 14-121, L 26-28: "Localized effects related to dewatering activities in the vicinity of intake pump stations and the expanded Clifton Court Forebay would temporarily lower groundwater levels by up to 10 feet and 20 feet, respectively."

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- There is no mitigation for loss of recreational income in the Sacramento – San Joaquin Delta for boating recreation due to low water levels from dewatering.
- There needs to be an assessment of the total number of jobs lost due to loss of recreation-oriented activities in the Sacramento – San Joaquin Delta and the number needs to be compared to the number of permanent positions provided by the BDCP (190).

STUDIES/PAPERS/REFERENCES/DOCUMENTATION, ETC.:

(3) Map: The Delta – Suisun Bay, Sacramento & San Joaquin Rivers – Fish and Map Co. shows river depth information.

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Date: July 27, 2014

Address: P.O. Box 255 (Address) Clarksburg (City) California (State) 95612 (Zip Code)

Document: EIR/EIS

Alternative 9—Through Delta/Separate Corridors (15,000 cfs; Operational Scenario G) (16.3.3.16)

Facilities constructed under Alternative 9 would include two fish-screened intakes along the Sacramento River near Walnut Grove, fourteen operable barriers, two pumping plants and other associated facilities, two culvert siphons, three canal segments, new levees, and new channel connections. Some existing channels would also be enlarged under this alternative. Nearby areas would be altered as work or staging areas or used for the deposition of spoils.

Chapter: 16 - Socioeconomics

Key Quote/Potential Impact:

EIS/EIR Impact Statement Executive Summary, Page ES-115

"Impact ECON-1: Temporary Effects on Regional Economics and Employment in the Delta Region during Construction of the Proposed Water Conveyance Facilities"

COMMENT 1:

Alternative 9: Changes in employment and income for recreational and tourism expenditures and their effects on regional economics and employment in the Sacramento – San Joaquin Delta have not been adequately analyzed for the temporary effects on regional economics and employment due to incomplete and omitted data. Precise conclusions cannot be drawn without complete and accurate data. Further studies to include updated information on recreation's and tourism's economic impact on the Sacramento-San Joaquin Delta needs to be developed and

included in this chapter. Not only is tourism omitted entirely, but recreation data is omitted in certain cases as well. For instance, while the effects on recreational economics are specifically described on EIR/EIS Page 16-264, L 5-28, for Alternative 9, Table 16-8 Delta Counties Annual Employment and Shares by Industry, 2006-2011 (Page 16-16) does not take into account Delta recreation and tourism, employment or economics.

In Alternative 9, Impact Econ-5 NEPA Effects on recreational economics only speak to agriculture mitigation and not to recreation and tourism operations' income lost due to water conveyance facilities construction.

In Table 16-10 Revenues and Expenditures by Delta Counties During Fiscal Years 2010-2011 (Page 16-18) the IMPLAN model was not used to estimate employment and income changes in recreation expenditures because direct changes in recreational expenditures have not been quantified.(1)(2)

The Delta's economy relies heavily upon agriculture, recreation and tourism.

Recreation and tourism play a vital part in the economic stability of the Delta. Additionally, recreation and agritourism have been on the increase over the past few years since the EIR/EIS was written. This is partly due to the increasing number of wineries and wine tasting venues in the Clarksburg area. There are currently approximately 27 wineries in the Sacramento River Delta Region including Bogle Winery, a well-known and international best seller. Sacramento is a 10 mile drive from the Delta wine tasting venue.

In the past year or so, the Delta's neighbor, Sacramento, has embraced the recent trend toward appreciation of urban agriculture and agritourism. Kevin Johnson, Mayor of Sacramento, has proclaimed Sacramento as America's Farm to Fork Capital(5); and he declared 2013 as the "Year of Food" in this region. Elaborate Farm to Fork celebrations are scheduled for two weeks in September, 2014, with "Legends of Wine Tasting" being highlighted on 9/18. This celebration attracted 25,000 people in 2013 and is expected to reach far beyond those numbers this year. Mayor Johnson's intention is to highlight local food and farms and celebrate the region's rich, diverse agricultural bounty. This event will be held 15 minutes from the Clarksburg Wine Appellation and the 27 wine tasting venues in the Delta.

New tourism businesses and opportunities have been developing to accommodate the interest in the local farming, wine tasting, and historical significance of the Sacramento River Delta. A Sacramento River Grown Farm Trail Map (3) and a

Tour Guide for the Delta (4) have been designed and distributed for easy access to tourists to enjoy this rich, diverse area.

A current example of nationwide interest in the Sacramento – San Joaquin Delta agriculture includes a tour scheduled for 45 farming students from the University of Nebraska during August, 2014. Recently, 38 retired school teachers from the Sacramento area toured the wineries and legacy towns of Locke and Walnut Grove. The Sacramento – San Joaquin River Delta Region is a sought after place that people enjoy for water recreation sports as well as land tourism opportunities.

SUPPORTING INFORMATION/ASSESSMENT

EIR/EIS Page 16-162, L 8-13: "***NEPA Effects:*** Because construction of water conveyance facilities would result in an increase in construction-related employment and labor income, this would be considered a beneficial effect. However, these activities would also be anticipated to result in a decrease in agricultural-related and labor income, which would be considered an adverse effect. Mitigation Measure AG-1, described in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, would be available to reduce these effects by preserving agricultural productivity and compensating off-site."

EIR/EIS Page 16-264, L 5-35: "***NEPA Effects:*** Under Alternative 9, three recreational facilities would be permanently displaced and 5 three others would be temporarily but directly or indirectly disturbed during construction, as 6 described in Chapter 15, *Recreation*, Section 15.3.3.16, Impacts REC-1 through REC-4. Construction 7 of Alternative 9 facilities would result in displacement and permanent loss of recreation facilities 8 including the Walnut Grove public guest dock, Boathouse Marina, and the Boon Dox guest dock in 9 Walnut Grove. Additionally, the quality of recreational activities including boating, fishing, 10 waterfowl hunting, and hiking in the Delta could be indirectly affected by noise, lighting, traffic, and 11 visual degradation in proximity to water conveyance construction. Recreation areas anticipated to 12 experience temporary or indirect effects include Delta Meadows State Park, Brannan Island State 13 Recreation Area, Sherman Island, Delta Meadows River Park, Stone Lakes National Wildlife Refuge, 14 Cosumnes River Preserve, Dagmar's Landing, Deckhands Marine Supply, Landing 63, Walnut Grove 15 Marina, Bullfrog Landing & Marina, Union Point Marina Bar & Grill, and Clifton Court Forebay.

Construction of water conveyance structures under this alternative would be anticipated to result in a lower-quality recreational experience in a number of

localized areas throughout the Delta, despite the implementation of mitigation measures, including enhancement of fishing access sites and incorporation of recreational access into project design, and environmental commitments, including providing funding to implement recreational improvements and control aquatic weeds, providing notification of maintenance activities in waterways and developing and implementing a noise abatement plan, as described in Appendix 3B, *Environmental Commitments*. With a loss of recreational facilities and a decrease in recreational quality, the number of visits would be anticipated to decline, at least in areas closest to construction activities. The multi-year schedule and geographic scale of construction activities and the anticipated decline in recreational spending would be considered an adverse effect. The commitments and mitigation measure cited above would contribute to the reduction of this effect.

***CEQA Conclusion*:** Construction of the proposed water conveyance facilities under Alternative 9 would be anticipated to impact recreational revenue through the loss of recreational facilities and a decrease in recreational quality. Fewer visits would be anticipated to result in decreased economic activity related to recreational activities. This section considers only the economic effects of recreational changes brought about by construction of the proposed water conveyance facilities. Potential physical changes to the environment relating to recreational resources are described and evaluated in Chapter 15, *Recreation,* Section 15.3.3.16, Impacts REC-1 through REC-4."

EIR/EIS Page 16-20, L 32-36: "The recreation-oriented focus of the Delta leads to an interdependent relationship between the different businesses. Fishing guides and boaters depend on the marinas for supplies and fuel. Marinas without food services rely on local food markets or restaurants to serve visitors. Restaurants and wineries depend on hotels to provide accommodations for overnight or extended visits. All the businesses depend on visitors and tourists spending time and money in the Delta."

EIR/EIS Page 16-22, L 23-27: "Recreation-oriented activities in the Delta were estimated to contribute approximately $236.3 23 million in direct expenditures in 2010. These direct expenditures are expected to grow to approximately $256 million by 2020, $269.9 million by 2025, and $375.4 million by 2060. As shown in Table 16-12, boating activity accounts for the largest share of total recreation-related economic contributions in the Delta."

EIR/EIS Page 16-43, L 28-32: "Changes in employment and income associated with changes in recreation expenditures were not estimated using a regional

IMPLAN model because direct changes in recreational expenditures have not been quantified."

IMPACTS NOT CORRECT OR NOT IDENTIFIED and IMPACT DESIGNATIONS:

- Loss of recreation expenditures is not in the IMPLAN which accounts for inter-county spending patterns.
- Loss of tourism due to construction noise, air quality and visual aesthetics in close proximity to Legacy Towns and their historic value is not adequately considered and addressed in the Socioeconomic Chapter of the EIR/EIS.
- All impacts are Adverse/Significant and Unavoidable.

MITIGATION:

- There needs to be an assessment of the total number of jobs lost due to loss of recreation-oriented activities in the Delta and the number needs to be compared to the number of permanent positions provided by the BDCP.
- Mitigation for loss of agricultural jobs and income is inadequate, as the tunnel will not replace the $130 million crop value that the estimated loss of 100,000 acres would accrue yearly. This is based on the estimated $650 million crop value for 480,000 acres of Delta irrigated acres (EIR/EIS Page 16-51, L 24-25).
- A study of the loss of recreation and tourism and their related economics and employment is requested to be completed to determine the effects of the lost potential income to the Delta and its related businesses as it relates to the overall water conveyance construction and activities. See second supporting paragraph below to identify lost recreational income sources.

STUDIES/PAPERS/REFERENCES/DOCUMENTATION, ETC.:

(1) The Brattle Group's Paper "Employment Impacts for Proposed Bay Delta Water Conveyance Facility and Habitat Restoration," February 22, 2013, www.brattle.com.

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(3) www.sacriverdeltagrown.org

(4) www.deltaheartbeattours.com

(5) http://www.sacbee.com/2013/10/30/5860288/growing-sacramentos-farm-to-fork.html

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Chapter: 16 - Socioeconomics

Key Quote/Potential Impact:

EIS/EIR Impact Statement Executive Summary, Page ES-115

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SUPPORTING INFORMATION/ASSESSMENT

EIR/EIS Page 16-162, L 8-13: "***NEPA Effects:*** Because construction of water conveyance facilities would result in an increase in construction-related employment and labor income, this would be considered a beneficial effect. However, these activities would also be anticipated to result in a decrease in agricultural-related and labor income, which would be considered an adverse effect. Mitigation Measure AG-1, described in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, would be available to reduce these effects by preserving agricultural productivity and compensating off-site."

EIR/EIS Page 16-264, L 5-35: "***NEPA Effects:*** Under Alternative 9, three recreational facilities would be permanently displaced and 5 three others would be temporarily but directly or indirectly disturbed during construction, as 6 described in Chapter 15, *Recreation*, Section 15.3.3.16, Impacts REC-1 through REC-4. Construction 7 of Alternative 9 facilities would result in displacement and permanent loss of recreation facilities 8 including the Walnut Grove public guest dock, Boathouse Marina, and the Boon Dox guest dock in 9 Walnut Grove. Additionally, the quality of recreational activities including boating, fishing, 10 waterfowl hunting, and hiking in the Delta could be indirectly affected by noise, lighting, traffic, and 11 visual degradation in proximity to water conveyance construction. Recreation areas anticipated to 12 experience temporary or indirect effects include Delta Meadows State Park, Brannan Island State 13 Recreation Area, Sherman Island, Delta Meadows River Park, Stone Lakes National Wildlife Refuge, 14 Cosumnes River Preserve, Dagmar's Landing, Deckhands Marine Supply, Landing 63, Walnut Grove 15 Marina, Bullfrog Landing & Marina, Union Point Marina Bar & Grill, and Clifton Court Forebay.

Construction of water conveyance structures under this alternative would be anticipated to result in a lower-quality recreational experience in a number of

localized areas throughout the Delta, despite the implementation of mitigation measures, including enhancement of fishing access sites and incorporation of recreational access into project design, and environmental commitments, including providing funding to implement recreational improvements and control aquatic weeds, providing notification of maintenance activities in waterways and developing and implementing a noise abatement plan, as described in Appendix 3B, *Environmental Commitments*. With a loss of recreational facilities and a decrease in recreational quality, the number of visits would be anticipated to decline, at least in areas closest to construction activities. The multi-year schedule and geographic scale of construction activities and the anticipated decline in recreational spending would be considered an adverse effect. The commitments and mitigation measure cited above would contribute to the reduction of this effect.

***CEQA Conclusion*:** Construction of the proposed water conveyance facilities under Alternative 9 would be anticipated to impact recreational revenue through the loss of recreational facilities and a decrease in recreational quality. Fewer visits would be anticipated to result in decreased economic activity related to recreational activities. This section considers only the economic effects of recreational changes brought about by construction of the proposed water conveyance facilities. Potential physical changes to the environment relating to recreational resources are described and evaluated in Chapter 15, *Recreation,* Section 15.3.3.16, Impacts REC-1 through REC-4."

EIR/EIS Page 16-20, L 32-36: "The recreation-oriented focus of the Delta leads to an interdependent relationship between the different businesses. Fishing guides and boaters depend on the marinas for supplies and fuel. Marinas without food services rely on local food markets or restaurants to serve visitors. Restaurants and wineries depend on hotels to provide accommodations for overnight or extended visits. All the businesses depend on visitors and tourists spending time and money in the Delta."

EIR/EIS Page 16-22, L 23-27: "Recreation-oriented activities in the Delta were estimated to contribute approximately $236.3 23 million in direct expenditures in 2010. These direct expenditures are expected to grow to approximately $256 million by 2020, $269.9 million by 2025, and $375.4 million by 2060. As shown in Table 16-12, boating activity accounts for the largest share of total recreation-related economic contributions in the Delta."

EIR/EIS Page 16-43, L 28-32: "Changes in employment and income associated with changes in recreation expenditures were not estimated using a regional

IMPLAN model because direct changes in recreational expenditures have not been quantified."

IMPACTS NOT CORRECT OR NOT IDENTIFIED and IMPACT DESIGNATIONS:

- Loss of recreation expenditures is not in the IMPLAN which accounts for inter-county spending patterns.
- Loss of tourism due to construction noise, air quality and visual aesthetics in close proximity to Legacy Towns and their historic value is not adequately considered and addressed in the Socioeconomic Chapter of the EIR/EIS.
- All impacts are Adverse/Significant and Unavoidable.

MITIGATION:

- There needs to be an assessment of the total number of jobs lost due to loss of recreation-oriented activities in the Delta and the number needs to be compared to the number of permanent positions provided by the BDCP.
- Mitigation for loss of agricultural jobs and income is inadequate, as the tunnel will not replace the $130 million crop value that the estimated loss of 100,000 acres would accrue yearly. This is based on the estimated $650 million crop value for 480,000 acres of Delta irrigated acres (EIR/EIS Page 16-51, L 24-25).
- A study of the loss of recreation and tourism and their related economics and employment is requested to be completed to determine the effects of the lost potential income to the Delta and its related businesses as it relates to the overall water conveyance construction and activities. See second supporting paragraph below to identify lost recreational income sources.

STUDIES/PAPERS/REFERENCES/DOCUMENTATION, ETC.:

(1) The Brattle Group's Paper "Employment Impacts for Proposed Bay Delta Water Conveyance Facility and Habitat Restoration," February 22, 2013, www.brattle.com.

(2) "Review of the Bay Delta Conservation Plan Statewide Economic Impact Report, August 2013 draft," Page 14; Dr. Jeffrey Michael, Director, Business Forecasting Center, Eberhardt School of Business, University of the Pacific, December 2013.

(3) www.sacriverdeltagrown.org

(4) www.deltaheartbeattours.com

(5) http://www.sacbee.com/2013/10/30/5860288/growing-sacramentos-farm-to-fork.html

BDCP 1754

Bay Delta Conservation Plan (BDCP) and Associated Draft Environmental Impact Report (EIR)/ Environmental Impact Statement (EIS) Comments

Name: Barbara Daly

Organization: North Delta C.A.R.E.S.

Date: July 28, 2014

Address: P.O. Box 255 (Address) Clarksburg (City) California (State) 95612 (Zip Code)

Document: EIR/EIS

Alternative 4—Dual Conveyance with Modified Pipeline/Tunnel and Intakes 2, 3, and 5 (9,000 cfs; Operational Scenario H) (16.3.3.9)

Alternative 4 would result in temporary effects on lands and communities associated with construction of three intakes and intake pumping plants, and other associated facilities; an intermediate forebay; conveyance pipelines; tunnels; an operable barrier at the head of Old River, and a new 600 acre Byron Tract Forebay, adjacent to and south of Clifton Court Forebay. Nearby areas would be altered as work or staging areas, concrete batch plants, fuel stations, or be used for spoils storage areas. Transmission lines, access roads, and other incidental facilities would also be needed for operations, and construction of these structures would also have effects on lands and communities.

Chapter: 15-Recreation

Key Quote/Potential Impact:

EIS/EIR Impact Statement Executive Summary, Page ES-112

REC-2: Result in long-term reduction of recreation opportunities and experiences as a result of constructing the proposed water conveyance facilities.

COMMENT 4:

Alternative 4: Long term reduction of recreational opportunities due to construction of conveyance facilities (CM1). Construction of the Alt. 4 conveyance facilities would adversely impact well-established recreational and tourism opportunities and experiences in the area because of access, noise, and visual setting disruptions that could result in loss of public use.

With the economic downturn that began in 2008 and continues to this day, the Sacramento-San Joaquin River Delta has begun to play a much more significant role in the recreational portfolio of those living near, and within, its borders. Not only are many incomes remaining stationary or dropping, but food and gas prices are steadily rising with increasing inflation.

With gas prices fluctuating around $4 per gallon, which significantly increases the cost of lengthy road trips, many Northern Californians are looking for recreational opportunities that are nearby.

Sacramentans and San Franciscans are looking increasingly to the Sacramento-San Joaquin River Delta to provide the extensive recreational experiences sought after by those wishing to escape the hectic city environment of these large metropolitan areas, and turn to a more rural experience. And, with less discretionary income, the recreational opportunities offered by the Delta Region are being sought after as they offer meaningful recreation and tourism at an affordable price.

The physical location of the Sacramento-San Joaquin River Delta, with its 1,100 miles of sloughs and waterways, is significant. It is flanked on the north by Sacramento, California's State Capital, and on the South by the San Francisco Bay Area. Both of these large metropolitan areas benefit recreationally because of their close proximity to the Delta.

The northern Sacramento-San Joaquin River Delta is literally in Sacramento's backyard, within a mere 15-minute drive to California's State Capitol in downtown Sacramento. This greater metropolitan area supports approximately 2 million people. The southern Delta is an approximately 45 – 60 minute drive from the greater San Francisco Bay Area, which, according to the bayareavision.org website, comprises 7,000 square miles, nine counties, 101 cities, and 7.1 million residents. The San Francisco Bay Area is the fifth most populous metropolitan area in the United States.(1)

Although tourism is not expanded upon in the EIR/EIS BDCP documents regarding the benefits and added value it provides to the recreation industry in the Sacramento-San Joaquin River Delta, tourism plays a significant role in Delta recreation and economics. Some of the recreational and tourism opportunities in the Delta include:

- Wine tasting (25% of California's wine grapes come from the Delta, special appellations of the Delta include Clarksburg and Lodi)
- Historical tours
- Boating
- Kayaking
- Wind surfing
- Fishing
- Agri-tourism
- Special cultural and community events

The Sacramento-San Joaquin Delta's recreational significance is mirrored in the abundance of visitors throughout the year. Per the Socioeconomics Chapter 16 "The Delta provides approximately 7.4 million visitor-days of recreational use (Plater and Wade 2002). Based on

state population growth trends, it was estimated that Delta visitation could reach 11.8 million visitor days by 2060." **(Page 16-21, L 19-22)**

Just east of Sacramento, the town of Folsom's newspaper, the Folsom Telegraph, touts the benefits of the Sacramento-San Joaquin River Delta with its unique view into the agrarian lifestyles of this river culture. In **Joel Gordiejew's June 24, 2014 article "On the Town: Take Time to Explore the Delta,"** he states "Are you looking for a unique, inexpensive and relaxing four–to-five–hour new adventure? If you haven't already visited the Delta Loop, I think I may have the ultimate experience for you." Mr. Gordiejew goes on to plug the benefits of the Delta and his experience of its Legacy towns as described in the Delta Heartbeat Tours' map. (See attached.) He also quotes the Delta Heartbeat Tour's mission statement which is to "create a safe journey to the Sacramento River Delta in an educational, entertaining and enriching way so that you will also tell others about this natural and cultural jewel in the heart of California and help preserve and protect it for future generations." Mr. Gordiejew's rich cultural experience of the Sacramento River Delta is described below in the entirety of his article.

Per the **Sacramento Bee's January 26, 2014 front page article "Arena's Impact Debated," (Page A-1)** Sacramento's proposed new sports arena is expected to bring an estimated 1.6 million visitors a year into downtown Sacramento. A mere 10 miles to the south, the Sacramento-San Joaquin River Delta offers a whole range of additional recreational and tourism opportunities to augment the entertainment experiences of these visitors to the State's Capital.

The EIR/EIS does not take into account the recreational opportunities in the Sacramento-San Joaquin River Delta and its close proximity to two major metropolitan areas in light of the current world-wide economic downturn. There needs to be a study to research, evaluate and determine the role the Delta plays in the extension of recreational opportunities for residents of Sacramento and the San Francisco Bay Area for day trips and weekend outings. Additional studies should be compiled to determine how the State and National economic climate is impacting recreation and tourism in the Sacramento-San Joaquin River Delta. This also needs to be compared to other trends of recreational and tourist activity country-wide.

www.sacramentoriverdeltagrown.com (See attached map)

www.deltaheartbeattour.com (See attached map)

Map: California Delta Boaters Map and Visitors Guide – NOAA Waterway Data and USGS Land Layout – California Delta Chamber of Commerce – 2014

SUPPORTING INFORMATION/ASSESSMENT

- **"On the Town: Take time to explore the Delta,"** by: Joel Gordiejew, Tuesday, June 24, 2014, Folsom Telegraph Newspaper:

  Are you looking for a unique, inexpensive and relaxing four-to-five-hour new adventure? If you haven't already visited the Delta Loop, I think I may have the ultimate experience for you.

  Memorial Day weekend my wife and I went in search of the Sacramento River Delta.

  Our inspiration for the outing came from a brochure published by Delta Heartbeat Tours (deltaheartbeattours.com). Their mission statement, which is spelled out on their attractive map, is to "create a safe journey to the Sacramento River Delta in an educational, entertaining and enriching way so that you will also tell others about this natural and cultural jewel in the heart of California and help preserve and protect it for future." I am passing it on.

  Our Delta Loop trek started at Freeport, a town just a short distance off I-5 south of Sacramento. Passing Freeport, we crossed the Freeport Bridge and headed south toward Clarksburg, a place we look forward to exploring more on our next trip.

  As we continued on Hwy 160 we came to the Island Road turnoff. This turn took us toward Grand Island Mansion, a private estate circa 1917. The mansion is a destination spot for weddings, receptions, special occasions, lodging and Sunday Brunch. Although I knew reservations to dine were required, I figured I had nothing to lose by asking if we could be seated. There just happened to be an opening and the gracious hostess obliged.

  Brunch was phenomenal. It sort of set the mood for the remainder of the Delta tour. If you plan to visit the mansion, I strongly suggest reservations before you go. You may not be as lucky as we were.

  Another possible brunch spot just down the road is the Ryde Hotel. Since we dined at the Grand Island Mansion, we skipped a visit to the Ryde for another time.

  During our five-hour excursion, we encountered numerous orchards, vineyards, wineries, farm stands, resorts, marinas, restaurants, unique structures and, one of the highlights, the historic town of Locke. This quaint community is chock-full of history and worth the stop.

  After Locke, we strolled the streets of Walnut Grove, just a short distance down the road. We visited a few shops, spent some cash and then moved on to complete our tour.

  All totaled, we passed through nine towns, rode two ferries (free of charge) and crossed a total of seven bridges during this 100-plus mile trek.

  We didn't get to see everything on the map, but made note so on our next tour, we'll be able to cover the areas missed on this initial visit.

  Here's a tip if you decide to explore this area. Pack a cooler with your favorite beverages and snacks and bring a blanket or some lawn chairs. There are plenty of spots on the loop to stop, kick back and absorb the sights.

We truly enjoyed our adventure. We hope you will, too.

http://www.edhtelegraph.com/article/town-take-time-explore-delta

IMPACTS NOT CORRECT OR NOT IDENTIFIED and IMPACT DESIGNATIONS:

- The close proximity of the two large metropolitan areas of Sacramento and the San Francisco Bay Area as well as the impacts of the current economic climate are not adequately discussed, thus all potential impacts are Adverse/Significant and Unavoidable.

MITIGATION:

- Mitigation is not adequate to address potential recreation and tourism impacts on the two large metropolitan communities on the northern and southern borders of the Sacramento-San Joaquin River Delta.

STUDIES/PAPERS/REFERENCES/DOCUMENTATION, ETC.:

(1) Http://www.bayareavision.org/bayarea/ "The San Francisco Bay Area, located in Northern California, consists of nine counties, 101 cities, and comprises 7,000 square miles. All of the region's nine counties share the San Francisco Bay. With 7.1 million residents, the San Francisco Bay Area is the fifth most populous metropolitan area in the United States."

BDCP 1754

Bay Delta Conservation Plan (BDCP) and Associated Draft Environmental Impact Report (EIR)/ Environmental Impact Statement (EIS) Comments

Name: Barbara Daly

Organization: North Delta C.A.R.E.S.

Date: July 28, 2014

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Document: EIR/EIS

Alternative 4—Dual Conveyance with Modified Pipeline/Tunnel and Intakes 2, 3, and 5 (9,000 cfs; Operational Scenario H) (16.3.3.9)

Alternative 4 would result in temporary effects on lands and communities associated with construction of three intakes and intake pumping plants, and other associated facilities; an intermediate forebay; conveyance pipelines; tunnels; an operable barrier at the head of Old River, and a new 600 acre Byron Tract Forebay, adjacent to and south of Clifton Court Forebay. Nearby areas would be altered as work or staging areas, concrete batch plants, fuel stations, or be used for spoils storage areas. Transmission lines, access roads, and other incidental facilities would also be needed for operations, and construction of these structures would also have effects on lands and communities.

Chapter: 15-Recreation

Key Quote/Potential Impact:

EIS/EIR Impact Statement Executive Summary, Page ES-112

REC-3: Result in Long-Term Reduction of Recreation Navigation Opportunities as a Result of Constructing the Proposed Water Conveyance Facilities

COMMENT 2:

Although REC-3 refers to reduction of recreation navigation opportunities as a result of constructing the proposed water conveyance facilities, the only impact that was addressed was from construction of the intake facilities, not the tunnels. There needs to be a study to determine what the effect will be from the dewatering needed to construct the tunnels and what impact that will have on the flow of the Sacramento River. Will the dewatering needed for construction of the tunnels impact the flow of the Sacramento River? If so, to what extent and for how long? How will this effect the boating recreation in the Delta? How will this effect other water-related recreation in the Delta?

How will transportation of the muck – with disposal of many truckloads per day affect recreation in the Delta?

How will the impaired aesthetics of staging and storage of muck affect recreation in the Delta?

IMPACTS NOT CORRECT OR NOT IDENTIFIED and IMPACT DESIGNATIONS:

- Does not consider effect of dewatering for construction of tunnels on water levels of the Sacramento River and subsequent effect on boating and other water-related recreation.
- Does not consider effect of muck from tunnel construction in the aesthetics and convenience of recreation in the Delta.
- **This impact is adverse/significant and unavoidable.**

MITIGATION:

- As tunnel construction is not addressed as an impediment to Recreational activities in the Delta, no mitigation is offered.

BDCP 1754

Bay Delta Conservation Plan (BDCP) and Associated Draft Environmental Impact Report (EIR)/ Environmental Impact Statement (EIS) Comments

Name: Barbara Daly

Organization: North Delta C.A.R.E.S.

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Chapter: 15-Recreation

Key Quote/Potential Impact:

EIS/EIR Impact Statement Executive Summary, Page ES-112

REC-3: Result in Long-Term Reduction of Recreation Navigation Opportunities as a Result of Constructing the Proposed Water Conveyance Facilities

COMMENT 1:

In the NEPA Effects section, the recreational boating impacts of construction of the proposed water conveyance facilities has been inadequately addressed and described. This section only takes into account boating concerns in the direct areas of intake and tunnel construction. While it is acknowledged that "direct effects on boat passage and navigation on the Sacramento River would result from construction of the intakes" **(Page 15-266, L 23-24)**, impact on boating access is underestimated as is stated "boat passage volume along the corridor of the Sacramento River where intakes are proposed is low." **(Page 15-266, L 26-27)** Even with this limited assessment of the effects, they are still, however, considered adverse. "… This could still result in a reduction of recreational navigational opportunities

would be considered adverse because, although temporary, the effects would be long-term, lasting more than 2 years." **(Page 15-266, L 33-35)** However, the full impact is not being recognized or addressed. With the dewatering of the Delta needed for the construction of the water conveyance facilities, it is expected to lower the water table between 10 – 20 feet. "Localized effects related to dewatering activities in the vicinity of intake pump stations and the expanded Clifton Court Forebay would temporarily lower groundwater levels by up to 10 feet and 20 feet, respectively. The pumping plants would be located just east of the Sacramento River, south of Freeport and north of Courtland." **(Page 14-121, L 26-29)** This would seriously affect the water levels in the Sacramento River below the pumping stations. A Fish-n-Map Co. map of the Delta waterways and the corresponding water levels throughout the Delta show that there is rarely an average flow that exceeds twenty feet in depth (an average of 18 feet from Clarksburg to Walnut Grove) along the entire flow of the Sacramento River through the Delta. **(See attached Fish-n-Map Co. map.)** Dewatering for construction will lower the water levels to a less than adequate 8 feet for a large portion of the recreational boating and associated boating-related facilities in the Delta. This could land-lock larger water vessels and boating marinas. Because of the extended timeframe of 4 – 8 years of construction, this could bankrupt many marinas and boating-related businesses. (See attached California Delta Boaters Map and Visitors Guide by the California Delta Chamber of Commerce.)

IMPACTS NOT CORRECT OR NOT IDENTIFIED and IMPACT DESIGNATIONS:

- Did not consider effect of dewatering on water levels of the Sacramento River and subsequent effect on boating and other water-related recreation.
- **This impact is adverse/significant and unavoidable.**

MITIGATION:

- Proposed mitigation is irrelevant. "TRANS-1a: Implement site-specific construction traffic management plan." **(Page ES-112)** Reduction in, and lack of, water for water recreation is not adequately mitigated.

BDCP 1154

Bay Delta Conservation Plan (BDCP) and Associated Draft Environmental Impact Report (EIR)/ Environmental Impact Statement (EIS) Comments

Name: Kim Glazzard

Organization: North Delta C.A.R.E.S.

Date: July 28, 2014

Address: P.O. Box 255 (Address) Clarksburg (City) California (State) 95612 (Zip Code)

Document: EIR/EIS

Alternative 4—Dual Conveyance with Modified Pipeline/Tunnel and Intakes 2, 3, and 5 (9,000 cfs; Operational Scenario H) (16.3.3.9)

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Chapter: 15-Recreation

Key Quote/Potential Impact:

EIS/EIR Impact Statement Executive Summary, Page ES-112

REC-2: Result in long-term reduction of recreation opportunities and experiences as a result of constructing the proposed water conveyance facilities.

COMMENT 6:

Alternative 4 and Alternative 9: Long term reduction of recreational opportunities due to construction of conveyance facilities (CM1). Construction of the Alt. 4 conveyance facilities would adversely impact well-established recreational opportunities and experiences in the area because of access, noise, and visual setting disruptions that could result in loss of public use.

The full importance of the Sacramento-San Joaquin River Delta Legacy Towns is not being recognized and the Delta Legacy Towns are not being protected as is required by the Delta Plan and the Delta Reform Act of 2009. These towns are pivotal in formation of California's early history. This important contribution is being ignored and these towns are in jeopardy of

being eliminated through the proposed construction of the water conveyance facilities. This is in direct conflict with what is in the Delta Plan.

The June 2012 Delta Stewardship Council Newsletter article "Legacy Communities Help Define the Delta" states: "The Delta Stewardship Council (Council) envisions a future where the Delta's unique qualities are recognized and honored, including the attributes of the Delta's historic towns.

Chapter 5 of the final draft of the Delta Plan includes policies and recommendations to protect and enhance the unique character and values of the Delta. Chapter 7 deals with reducing risk to people, property, and State interests in the Delta. Walnut Grove and Locke are examples of two of the earliest modern-day settlements along the Sacramento River. They are two of the legacy communities in the Delta with a rich past and vibrant culture, which can capitalize on "heritage tourism" as a means for economic development.

Socioeconomics Chapter 16 states "Heritage tourism in the Delta occurs in small historic towns along the Sacramento River that developed as steamboat landings during the Gold Rush. Freeport, Clarksburg, Hood, Courtland, Locke, Walnut Grove, Ryde, Isleton and Rio Vista are all considered legacy towns." **(Page 16-21, L 10-12)** It also states "Heritage tourism involves traveling to experience an area's historic, cultural, and natural resources (National Trust for Historic Preservation 2010). Examples include visits to historic sites, national and state parks, museums, festivals, and other cultural events (D. K.Shiflett and Associates 2000)." **(Page 16-21, L 7-9)**

The Recreation Chapter, under Visiting Historic Sites **(Page 15-7, L 1-11)**, states that "The Delta has a long and varied history of human use and, therefore, has many historic sites, several of which are associated with legacy towns, such as Isleton, Locke, and Walnut Grove. (The term "legacy town" is applied to several small, historic towns along the Sacramento River in the Delta that were originally established as riverboat ports.) Self-guided walks, available in both Locke and Walnut Grove, take visitors past old sites and buildings, including residences, a market, gambling museum, blacksmith shop, butcher shop, and bank. Visitors can stop at historic sites in the Delta year-round. DPR [Department of Parks and Recreation] and the Sacramento Housing and Redevelopment Agency have restored a former Chinese immigrant boarding house in Locke to preserve its history (Reyman Construction 2011). The project also includes a visitor's center and interpretative exhibits within the boarding house (Locke Foundation 2012)."

Not only will valuable tourism opportunities be lost with construction of the water conveyance facilities, but a significant part of California's history will be jeopardized and compromised with the loss of the Legacy Towns and their agrarian settings for the experiential education for all future generations.

www.sacramentoriverdeltagrown.com (See attached map)

www.deltaheartbeattour.com (See attached map)

Map: California Delta Boaters Map and Visitors Guide – NOAA Waterway Data and USGS Land Layout – California Delta Chamber of Commerce – 2014

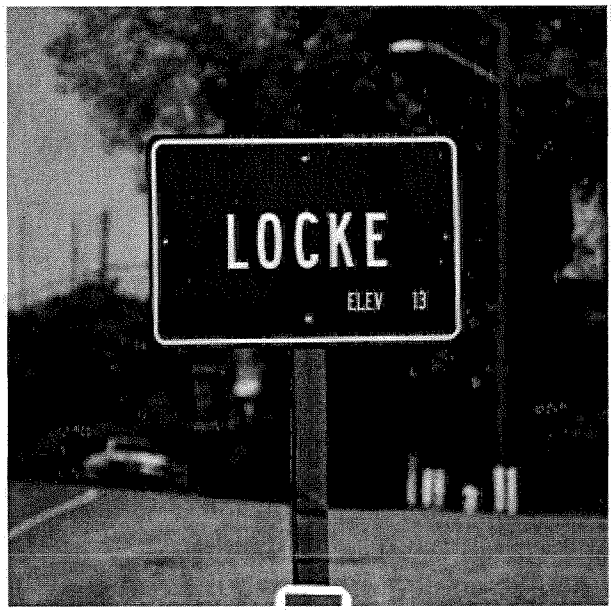
SUPPORTING INFORMATION/ASSESSMENT

- "Legacy," as in "legacy town" is defined as "one from a previous time that has influence now" and "anything handed down from the past, as from an ancestor or predecessor," per www.yourdictionary.com/legacy.
- The **Delta Reform Act of 2009** designated a number of unincorporated legacy communities in the Delta including Freeport, Clarksburg, Courtland, Hood, Locke, Walnut Grove, Isleton, and Rio Vista, as well as Bethel Island and Knightsen. These communities exemplify the Delta's unique cultural history and contribute to the sense of the Delta as a place. They enjoy colorful history, and coupled with the river recreation and wine tasting region, this area is the next tourism draw for the Sacramento area.
- **The Delta Reform Act of 2009, 85021:** "The policy of the State of California is to reduce reliance on the Delta in meeting California's future water supply needs through a statewide strategy of investing in improved regional supplies, conservation, and water use efficiency. Each region that depends on water from the Delta watershed shall improve its regional self-reliance for water through investment in water use efficiency, water recycling, advanced water technologies, local and regional water supply projects, and improved regional coordination of local and regional water supply efforts."
- The goals of the **Bay Delta Conservation Plan** are "providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem. The co-equal goals shall be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place."
- Delta Stewardship Newsletter, June 2012 States:

Legacy Communities Help Define the Delta

June 2012

BDCP 1754



The California Delta is a unique place distinguished by its diverse geography, vibrant natural resources, rich agriculture and legacy communities. The Delta Stewardship Council (Council) envisions a future where the Delta's unique qualities are recognized and honored, including the attributes of the Delta's historic towns.

Chapter 5 of the final draft of the Delta Plan includes policies and recommendations to protect and enhance the unique character and values of the Delta. Chapter 7 deals with reducing risk to people, property, and State interests in the Delta.

Walnut Grove and Locke are examples of two of the earliest modern-day settlements along the Sacramento River. They are two of the legacy communities in the Delta with a rich past and vibrant culture, which can capitalize on "heritage tourism" as a means for economic development.

Both Walnut Grove and Locke had large Asian populations who worked at packing sheds and on local farms in the late 1800s. These early residents help shape and define the communities that are still thriving today.

Established in 1850, Walnut Grove quickly blossomed into an agricultural hotspot, and within 20 years, it was a bustling town full of small businesses. Chinese immigrants began to call Walnut Grove home during the 1880s. Just past the turn of the century, a large Japanese community began to emerge in Walnut Grove, relocating from Japan and from disparate places in California.

After a fire broke out in the Asian section of Walnut Grove in 1915, the rebuilding took on a much different tone than the previous architecture. Japanese builders from throughout Northern California arrived in the town and quickly made an impression by developing a Japanese commercial district.

The fire also heralded the birth of a new community, Locke. In search of a place to call their own, the Chinese immigrants who had called Walnut Grove home made a deal with George Locke to establish their own settlement. The Chinese immigrants took to their tools to build the town to reflect their culture and history. Originally called Lockeport, Locke looks almost the same now as it did when it was finished in 1920. At its peak, as many as 1,500 people called Locke home.

 In 1970, the Sacramento County Historical Society added Locke to the national registry of historic places as the only town in the U.S. built exclusively by the Chinese for the Chinese.

The Delta Plan incorporates many of the recommendations in the Delta Protection Commission's Economic Sustainability Plan (ESP), which notes the importance of enhancing the legacy themes of the Delta's historical communities, and creating better awareness of them. The ESP recommends improving legacy towns' lodging and entertainment; restoring historic buildings; and promoting context-sensitive infill development.
The final staff draft Delta Plan recommends the Delta be named a National Heritage Site to protect its status as a unique and special place in California.

IMPACTS NOT CORRECT OR NOT IDENTIFIED and IMPACT DESIGNATIONS:

- There is no significant mention to the losses to tourism, nor mitigation offered to address recreational and tourism impacts particularly in relationship to the Sacramento-San Joaquin Legacy Towns, thus all impacts are Adverse/Significant and Unavoidable.

MITIGATION:

- Mitigation is not adequate to address impacts on all recreation in the Delta, including tourism and agritourism, especially as it relates to the loss of the historical aspects of the Legacy Towns.
- There is no mitigation offered for loss of recreational income and historical Legacy Towns with the construction of the proposed water conveyance facilities.

BDCP 1754

Bay Delta Conservation Plan (BDCP) and Associated Draft Environmental Impact Report (EIR)/ Environmental Impact Statement (EIS) Comments

Name: Barbara Daly

Organization: North Delta C.A.R.E.S.

Date: July 28, 2014

Address: P.O. Box 255 (Address) Clarksburg (City) California (State) 95612 (Zip Code)

Document: EIR/EIS

Alternative 4—Dual Conveyance with Modified Pipeline/Tunnel and Intakes 2, 3, and 5 (9,000 cfs; Operational Scenario H) (16.3.3.9)

Alternative 4 would result in temporary effects on lands and communities associated with construction of three intakes and intake pumping plants, and other associated facilities; an intermediate forebay; conveyance pipelines; tunnels; an operable barrier at the head of Old River, and a new 600 acre Byron Tract Forebay, adjacent to and south of Clifton Court Forebay. Nearby areas would be altered as work or staging areas, concrete batch plants, fuel stations, or be used for spoils storage areas. Transmission lines, access roads, and other incidental facilities would also be needed for operations, and construction of these structures would also have effects on lands and communities.

Chapter: 15-Recreation

Key Quote/Potential Impact:

EIS/EIR Impact Statement Executive Summary, Page ES-112

REC-2: Result in long-term reduction of recreation opportunities and experiences as a result of constructing the proposed water conveyance facilities.

COMMENT 2:

Alternative 4: Long term reduction of recreational opportunities due to construction of conveyance facilities (CM1). Construction of the Alt. 4 conveyance facilities would adversely impact well-established recreational opportunities and experiences in the area because of access, noise, and visual setting disruptions that could result in loss of public use.

The data used to evaluate recreation in the Sacramento-San Joaquin River Delta is either missing, inadequate, or outdated. Many of the tables of fundamental aspects of Delta recreation reflect data from sources that goes back 10 – 15 years or more. For example, **EIR/EIS Table 15-2** "Summary of Public and Private Delta Recreational Facilities by County" **(EIR/EIS Page 15-7)** references the Delta Protection Commission 1997, 2006 as its

sources and **EIR/EIS Table 15-3** "Estimates of Boating, Fishing and Day Use in the Delta" **(EIR/EIS Page 15-20)** is using data from 1997. As recreation is central to the Delta economy and cultural significance, current up-to-date studies of all the different aspects of recreation and tourism in the Delta need to be conducted to accurately identify and assess the individual benefits and scope of these recreational activities – and their subsequent value and synergistic relationships to the greater Delta communities.

Recent research and compilation of this information is needed to develop an accurate evaluation and assessment of what the true impacts of construction of the water conveyance facilities will be on recreation and tourism in the Sacramento-San Joaquin River Delta. The financial effects that construction of the proposed water conveyance facilities will have on recreation in the Delta have also not been adequately addressed in the EIR/EIS. The lack of adequate and up-to-date data invalidates the results and conclusions presented in the Recreation Chapter 15. Up-to-date, expanded and more inclusive studies are critical to present defensible and authoritative conclusions within the BDCP's EIR/EIS.

Also, meaningful data on tourism in the Delta is absent from Recreation Chapter 15. There is significant agritourism in the North Sacramento-San Joaquin River Delta through the numerous local wineries. Clarksburg appellation boasts nearly 25 wineries, and is a key producer of wine grapes in California.

SUPPORTING INFORMATION/ASSESSMENT

- Table 15-2, Page 15-7

Table 15-2. Summary of Public and Private Delta Recreational Facilities by County 22

Recreation Facility	Alameda	Contra Costa	Sacramento	San Joaquin	Solano	Yolo
Marinasa	1	47	31	31	3	5
Fishing Access	0	9	7	6	0	2
Hunting Areas	0	7	3	4	3	18
Public Boat Rampsb	0	3	5	5	0	1
Trail Access	0	2	3	2	0	1
Camping Areasb	0	0	5	2	0	0
Windsurf Access	0	0	5	0	0	0

Sources: Delta Protection Commission 1997, 2006.

a For the purposes of this summary, yacht clubs and sailing clubs are included in the marina totals.

b Some marinas also have a public-use ramp and/or recreational vehicle or tent camping areas available for a fee; those facilities are not included in the tallies of public boat ramps or stand-alone camping areas.

- Table 15-3, Page 15-7

Table 15-3. Estimates of Boating, Fishing, and Day Use in the Delta 31

Activity	Visitor-Day[a] Use Estimate (1997)[c]
Boating	4.71 Million
Fishing (from shore and by boat)	1.00 Million
Day Use[b]	0.66 Million
Total Annual Recreation Use	6.37 Million

Source: Plater and Wade 2002

a A visitor-day is equivalent to 12 hours of recreation activity. This activity may represent one visitor recreating for 12 hours or more than one visitor recreating for shorter periods.
b Day use includes all nonboating or fishing activities.
c At the time of this draft EIR/S, there was no data more current than 1997.

- **Wikipedia:** "The **Clarksburg AVA** is an American Viticultural Area that spans three counties in California's Sacramento Valley. Located in portions of Sacramento County, Solano County, and Yolo County, the Clarksburg AVA includes 64,640 acres (26,159 ha) near the town of Clarksburg. The growing region has dense clay and loam soils. Fog and cool breezes from San Francisco Bay keep the Clarksburg area cooler than nearby Sacramento. 90% of the grapes grown in the Clarksburg AVA are crushed in winery facilities located elsewhere in California, and relatively few wines are released with the Clarksburg AVA on their labels."[1]

- **AppellationAmerica.com States:** "The Clarksburg appellation – which enfolds 56,900 acres of rich farmland spanning Sacramento, Solano and Yolo counties – is blessed with many graces. Sixteen miles long and eight miles wide, it has over 10,000 acres of vines. With poorly-drained clay and loam soils, this appellation combines arid conditions with a nutrient-rich base. Summer days are warm here, but in late afternoon, cool breezes from San Francisco Bay roll into the Sacramento River Delta, preserving acidity in the ripening fruit. The air mass keeps the Clarksburg AVA an average of nine degrees cooler than neighboring Sacramento.

  "More than twenty five wine grape varietals thrive in the AVA. So why is this very large and very productive appellation so little known? Alas, best results in this terroir are achieved by Chenin Blanc and Petite Sirah... read: *not Chardonnay and Cabernet Sauvignon.* While the Clarksburg appellation produces over 40,000 tons of grapes annually, 90% of it is crushed outside the appellation. Multiple wineries, both in and outside the AVA, are now producing under the AVA name, which may signal much deserved future recognition.

  "New facility projects such as conversion of The Old Sugar Mill, a shuttered beet sugar processing facility, into a major multiple winery facility has certainly presented opportunity for expanded presence of wines of this appellation."(2)

IMPACTS NOT CORRECT OR NOT IDENTIFIED and IMPACT DESIGNATIONS:

- Inadequate or missing background information and data do not allow the credible development of educated conclusions as to the designations of the impacts for either CEQA or NEPA.

MITIGATION:

- Background material is inferior and inadequate for drawing conclusions for mitigation as the foundational data is outdated and incomplete.

STUDIES/PAPERS/REFERENCES/DOCUMENTATION, ETC.:

(1) https://en.wikipedia.org/wiki/Clarksburg_AVA
(2) AppellationAmerican.com

BDCP 1754

Bay Delta Conservation Plan (BDCP) and Associated Draft Environmental Impact Report (EIR)/ Environmental Impact Statement (EIS) Comments

Name: Barbara Daly

Organization: North Delta C.A.R.E.S.

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Chapter: 15-Recreation

Key Quote/Potential Impact:

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REC-2: Result in long-term reduction of recreation opportunities and experiences as a result of constructing the proposed water conveyance facilities.

COMMENT 3:

Alternative 4: Long term reduction of recreational opportunities due to construction of conveyance facilities (CM1). Construction of the Alt. 4 conveyance facilities would adversely impact well-established recreational and tourism opportunities and experiences in the area because of access, noise, and visual setting disruptions that could result in loss of public use.

Tourism in the Delta is not expanded upon in the EIR/EIS, and only peripherally alluded to in Recreation Chapter #16. Additionally, agritourism is rarely mentioned. These are serious omissions that need to be addressed in the document. Tourism, particularly in the northern part of the Delta is pivotal and growing exponentially. In the past three years at least three new tourist businesses have established roots in the Northern Sacramento-San Joaquin River

Delta. They are Discover the Delta (www.discoverthedelta.org), Delta Heartbeat Tours (www.deltaheartbeattours.com) and the Sacramento River Delta-Grown Farm Trail (www.sacriverdeltagrown.org).

Tourism historically, and to this day, has played a vital role in Sacramento-San Joaquin River Delta recreation and economics. Tourism showcases the Delta's well-rounded opportunity for people to come out and enjoy the water, tour the wineries, enjoy the rural agrarian atmosphere, visit museums, and shop in the quaint legacy towns which feature local artisans.

Recreation and agritourism have been on the increase over the past few years, and since the EIR/EIS was written. This is partly due to the increasing number of wineries and wine tasting venues in the Clarksburg area. Clarksburg, in fact has its own wine appellation (see additional information below). There are approximately 25 wineries in the Sacramento River Delta Region including Bogle Vineyards, a well-known and international bestseller. (See below information.) Other Clarksburg Wineries include: Carvalho Family Wines, Heringer Estates, R. Merlo at the Old Sugar Mill, Scribner Bend Vineyards, Wilson Vineyards, Clarksburg Wine Company, Draconis, Due Vigne di Famiglia, Ehrhardt Estates Winery, Rendez-Vous Winery, River Grove Winery, Scribner Bend Vineyards, Three Wine Company, Todd Taylor Wines, Twisted Rivers, Wilson Vineyards, Miner's Leap Winery, Tierra del Rio Vineyards, Dancing Coyote Wines, Six Hands Winery, Watts Winery, Benson Ferry Winery, Gramds Amis Winery, and Elevation Ten.

The agrarian ambiance of the Clarksburg Appellation will be seriously compromised by the construction, blight, noise, poor air quality and by turning this adjacent area to the Appellation into an industrial water complex. The construction for Alternative 4 will be visually noticeable to winery tour and agritourism visitors, as it is directly across the Sacramento River from the Bogle Winery.

With Sacramento's location being a mere 10 miles from the Sacramento-San Joaquin River Delta, and with its recent Farm to Fork Capital recognition (see below), the Delta's new Sacramento River Grown Farm Trail is drawing Sacramentans, Bay Area residents, and other tourists nationwide to visit the Delta. This current emphasis on the Delta's agritourism, along with its legacy town historical focus, has been enhanced by contemporary land maps have been designed and distributed to help visitors navigate this unique Delta Region with its hundreds of miles of recreational sloughs and waterways. (See below.)

A current example of nationwide interest in the Sacramento-San Joaquin River Delta includes a tour for 45 livestock and farming students from the University of Nebraska, which has been scheduled for August 9, 2014. The Delta Region is a sought after place that people enjoy for water recreation sports as well as land tourism and agritourism opportunities.

The Sacramento County and Yolo County Plans are also supportive of tourism and agritourism. The Socioeconomic Chapter **16.2.3.2 (Page 16-35, L 25)** describes one of the strategic objectives of the economic development element that was included as part of the 2011 update to the Sacramento County General Plan to "Promote agriculture and

agritourism." The Socionomic Chapter 16.2.3.5 **(Page 16-37, L 27-29)** goes on to include Policy CC-2.4 from the Yolo County General Plan, which states "Where appropriate, include economic development in the unincorporated communities that serves intra-county and regional tourism."

Recreation is not assessed and evaluated in its totality in the BDCP EIR/EIS. The approach of singling out only certain aspects of recreation in the Sacramento-San Joaquin River Delta, and evaluating these individually is inadequate. Both general tourism as well as agritourism are insufficiently addressed in Recreation Chapter 16. Current, up-to-date, and extensive studies are needed to effectively evaluate the total holistic picture of recreation and tourism in the Delta. Special attention should be paid to how tourism is affected by the Delta's legacy towns of Freeport, Clarksburg, Courtland, Hood, Walnut Grove, Ryde, Locke, Isleton, and Rio Vista, and how the tourism industry will be adversely impacted by the construction of the water conveyance facilities. (See below.)

www.sacramentoriverdeltagrown.com (See attached map)

www.deltaheartbeattour.com (See attached map)

Map: California Delta Boaters Map and Visitors Guide – NOAA Waterway Data and USGS Land Layout – California Delta Chamber of Commerce – 2014

SUPPORTING INFORMATION/ASSESSMENT

- **EIR/EIS Page 16-21, L 10-12:** The Socioeconomics Chapter 16 states "Heritage tourism in the Delta occurs in small historic towns along the Sacramento River that developed as steamboat landings during the Gold Rush. Freeport, Clarksburg, Hood, Courtland, Locke, Walnut Grove, Ryde, Isleton and Rio Vista are all considered legacy towns."

- **Wikipedia:** "The **Clarksburg AVA** is an American Viticultural Area that spans three counties in California's Sacramento Valley. Located in portions of Sacramento County, Solano County, and Yolo County, the Clarksburg AVA includes 64,640 acres (26,159 ha) near the town of Clarksburg. The growing region has dense clay and loam soils. Fog and cool breezes from San Francisco Bay keep the Clarksburg area cooler than nearby Sacramento. 90% of the grapes grown in the Clarksburg AVA are crushed in winery facilities located elsewhere in California, and relatively few wines are released with the Clarksburg AVA on their labels."[1]

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fruit. The air mass keeps the Clarksburg AVA an average of nine degrees cooler than neighboring Sacramento.

More than twenty five wine grape varietals thrive in the AVA. So why is this very large and very productive appellation so little known? Alas, best results in this terroir are achieved by Chenin Blanc and Petite Sirah... read: *not Chardonnay and Cabernet Sauvignon.* While the Clarksburg appellation produces over 40,000 tons of grapes annually, 90% of it is crushed outside the appellation. Multiple wineries, both in and outside the AVA, are now producing under the AVA name, which may signal much deserved future recognition.

New facility projects such as conversion of The Old Sugar Mill, a shuttered beet sugar processing facility, into a major multiple winery facility has certainly presented opportunity for expanded presence of wines of this appellation."(2)

- **Article: "The Secret AVA: Clarksburg" by Jean Deitz Sexton June 16, 2009:** "**Nestled along the Sacramento Delta waterways**, the Clarksburg AVA, about 20 minutes outside downtown Sacramento off of I-5 South, is largely known for growing white varietals, the dominant grapes being Chardonnay, Chenin Blanc, Pinot Grigio and Sauvignon Blanc. . . . Wine lovers may be aware of Lodi grapes from the Delta wine growing region but the sleeper is Clarksburg, an old-timey northern Delta town which anchors the Clarksburg AVA (American Viticultural Area) in which 14,000 acres are planted to grapes. . . . The AVA has largely been a growers' market, with multigenerational farming families lending Clarksburg a peaceful, settled vibe. The area gained AVA status in 1987 but its agricultural roots date back to the 1860s when the Bogle family settled in the area, first

Jody-Bogle with director of winemaking, Chris-Smith as tenant farmers and later as landowners when Warren Bogle farmed row and seed crops, including wheat, sunflower and celery seed. In 1968, Bogle wanted to try something different and planted some Petite Sirah and Chenin Blanc. Eventually, the Bogle land transitioned to a grape crop and today Bogle Vineyards farms 1,500 acres of grapes. Warren's son, the late Chris Bogle, was instrumental in getting the Clarksburg AVA approved. Chris' wife Patty, their daughter, Jody Bogle, and their son Warren, are handling day-to-day operations, with veteran winemaker Chris Smith overseeing viticulture and production.

Bogle Vineyards is the most powerful brand in the Clarksburg AVA, and really the only high-volume winery with national distribution, producing more than a million cases annually. However, while credited with creating the Clarksburg AVA, Bogle is avoiding, for the most part, using the AVA designation on its labels. "If you're selling wine in New York City, they don't know Clarksburg but they do know California, "says Smith. Bogle does sell some smaller lots of Clarksburg designate wines out of its tasting room.

Some growers are seeing the beginning of customer recognition of the Clarksburg AVA. Ken Wilson of Wilson Vineyards has 800 acres planted to grapes, and similar to Bogle, his family has a long farming history, theirs dating back to 1922. About 35 percent of his crop is Chardonnay, with other major varietals being Chenin Blanc, Sauvignon Blanc, Pinot Noir and Petite Sirah.

Wilson, who supplies fruit to Don Sebastiani & Sons, to the Diageo Chateau & Estate Wines portfolio and Beringer, among others, is seeing wineries starting to use the Clarksburg designation, as well as putting his own Wilson Vineyards name on their labels.

"Wineries using the Clarksburg designation put a positive light on us," says Wilson. "Not only consumers but also winery people can see what kind of quality wine can be produced from Clarksburg fruit." Case in point: Dry Creek Vineyards 2007 Chenin Blanc is produced from Wilson's fruit and uses the Clarksburg AVA on the label. . . .

While Chenin Blanc is the second largest white varietal planting in the Clarksburg AVA, according to the Clarksburg Wine Growers Association – Chardonnay being the first – Wilson does not expect Chenin Blanc to be the next Pinot Grigio. "There is a certain market segment that follows it and loves it, however" says Wilson. Bogle Vineyards is finding a market for its Chenin Blanc in Asia, the UK and Ireland, as well as in tasting room sales, says Smith."(3)

- **Farm to Fork Festival: Presented by Farm to Fork Capital at Capitol Mall Greens.** Celebrating our region's rich, diverse agricultural bounty, Sacramento has been dubbed the "Farm-to-Fork Capital of America." No major city in America is more centrally located amid such a diverse range of high-quality farms, ranches, and vineyards.

  Local restaurants utilize the abundance of regionally-grown products to create a Farm-to-Fork freshness that's unparalleled in this country.(4)

- **EIR/EIS Page 16-20, L 32-36:** "The recreation-oriented focus of the Delta leads to an interdependent relationship between the different businesses. Fishing guides and boaters depend on the marinas for supplies and fuel. Marinas without food services rely on local food markets or restaurants to serve visitors. Restaurants and wineries depend on hotels to provide accommodations for overnight or extended visits. All the businesses depend on visitors and tourists spending time and money in the Delta."

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IMPACTS NOT CORRECT OR NOT IDENTIFIED and IMPACT DESIGNATIONS:

- Mitigation is not adequate to address the serious impacts that construction of the water conveyance facilities will have on recreation and tourism in the Sacramento-San Joaquin River Delta, thus all impacts are Adverse/Significant and Unavoidable.

MITIGATION:

- Mitigation is not adequate to address impacts on all recreation in the Delta, including tourism and agritourism due to incomplete and inadequate data in the content of the EIR/EIS.

STUDIES/PAPERS/REFERENCES/DOCUMENTATION, ETC.:

(1) https://en.wikipedia.org/wiki/Clarksburg_AVA
(2) AppellationAmerican.com
(3) **Article: "The Secret AVA: Clarksburg" by Jean Deitz Sexton June 16, 2009** "Appellation America, http://wine.appellationamerica.com/aboutus.aspx
(4) Farm to Fork Festival: http://www.sacramento365.com/event/detail/441726807/Farm_to_Fork_Festival

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Chapter: 15-Recreation

Key Quote/Potential Impact:

EIS/EIR Impact Statement Executive Summary, Page ES-112

REC-2: Result in long-term reduction of recreation opportunities and experiences as a result of constructing the proposed water conveyance facilities.

COMMENT 1:

Alternative 4: Long term reduction of recreational opportunities due to construction of conveyance facilities (CM1). Construction of the Alt. 4 conveyance facilities would adversely impact well-established recreational opportunities and experiences in the area because of access, noise, and visual setting disruptions that could result in loss of public use.

SUPPORTING INFORMATION/ASSESSMENT

- Construction-related impacts on informal fishing access sites along the east/west bank of the Sacramento River in vicinity of proposed intakes would be considered significant and unavoidable because construction would alter the river bank and/or restrict access in such a fashion to make these sites unusable.

BDCP 1754

- **EIR/EIS Page 15-255, L 31-33.** Six recreation sites or areas are within the 1,200 to 1,400 foot indirect impact associated with aboveground construction of the new water conveyance facilities.
    - **EIR/EIS Page 15-257, L 2-4**. Indirect construction noise effect on recreation in the vicinity of the **Clarksburg Boat Launch facility** across the river from the proposed Intake 3 site would last about 5 years, with construction of the intake and related facilities taking place Monday – Friday for up to 24 hours each day. There are few public boat launches in the Delta recreational area between Rio Vista and Freeport on the Sacramento River, therefore this would significantly impact the boating and fishing recreation.
    - **EIR/EIS Page 15-256, L 5-14 and L 21-22. Stone Lakes National Wildlife Refuge** could experience adverse effects on wildlife viewing and environmental education opportunities due to proximity to the noise of construction works areas borrow/spoils sites as well as adversely impacting nesting birds and waterfowl populations, including greater sandhill cranes.
    - **EIR/EIS Page 15-258, L 20-22 and 26-32. Wimpy's Marina** is within the noise and visual disturbance impact area and is across the river from a tunnel corridor, a vent shaft, a temporary tunnel work area, a temporary access road, and a temporary transmission line. The 230 kV temporary transmission line construction could take up to 3.5 years, during which time marina users would be disturbed by noise and visual disruptions related to the construction activities. Anglers on the river near the marina and across from the construction area would also experience adverse impacts from the noise and visual disturbances of the construction. The tunnel construction and use of the temporary work area would take up to 8 years and would be considered a long-term adverse effect.
    - **EIR/EIS Page 15-258, L 37-40.** Westgate Landing Park would be used to house reusable tunnel material (muck) for up to 8 years during tunnel construction and would adversely affect the recreation experience of visitors across the river due to noise and visual disturbances. Construction would primarily take place Monday through Friday, for up to 24 hours per day.
    - **EIR/EIS Page 15-257, L 22-23 and L 29-30. Cosumnes River Preserve** would experience construction noise if the east-west permanent transmission line is implemented. Disruption would be for up to 3.5 years.
    - **EIR/EIS Page 15-259, L 20-24. Bullfrog Landing Marina** on Middle River is southeast of the terminus of permanent access road to ventilation/access shaft for the tunnel/pipeline alignment across Bacon Island. Noise and visual disruptions related to the construction activities could affect marina users and anglers. Construction activities could last up to 8 years, resulting in a long-term adverse effect.

BDCP 1754

IMPACTS NOT CORRECT OR NOT IDENTIFIED and IMPACT DESIGNATIONS:

- All impacts are Adverse/Significant and Unavoidable.

MITIGATION:

- Loss of recreational opportunities and the quaint agrarian pastoral ambiance of the Delta, which is one of its signature features, cannot be mitigated through the proposed mitigations. These mitigations are inadequate.
- There is no mitigation for loss of recreational income in the Delta including as noted in above Comment 1.

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Chapter: 15-Recreation

Key Quote/Potential Impact:

EIS/EIR Impact Statement Executive Summary, Page ES-115

REC-1: Permanent displacement of existing well-established public use or private commercial recreation facility available for public access as a result of the location of the proposed water conveyance facilities.

COMMENT 1:

Alternative 4: The assertion under NEPA Effects that "the location of the proposed water conveyance facilities would not result in the permanent displacement of existing well-established public use or private commercial recreation facilities" (Page 15-254, L 38-40) is inaccurate. Recreation-oriented businesses and other commercial recreation facilities in the immediate vicinity of the construction of the water conveyance facilities will suffer severe and adverse impacts to the recreation industry. The NEPA Effects are taking into account only a fraction of the public use or private commercial recreation facilities that will be impacted by the construction. For instance, the construction of the Intake Facility #3 will displace the majority of the town of Hood.

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SUPPORTING INFORMATION/ASSESSMENT:

- **EIR/EIS Page 16-48, L 16-19:** "Changes related to recreational economics. For the purposes of this analysis, an adverse socio-economic effect would occur when construction or operations and maintenance activities result in loss of public access to or public use of well-established recreation facilities or activities lasting for more than 2 years."
- **EIR/EIS Page 16-20, L 32-36:** "The recreation-oriented focus of the Delta leads to an interdependent relationship between the different businesses. Fishing guides and boaters depend on the marinas for supplies and fuel. Marinas without food services rely on local food markets or restaurants to serve visitors. Restaurants and wineries depend on hotels to provide accommodations for overnight or extended visits. All the businesses depend on visitors and tourists spending tie and money in the Delta."

"***NEPA Effects:*** Because construction of water conveyance facilities would result in an increase in construction-related employment and labor income, this would be considered a beneficial effect. However, these activities would also be anticipated to result in a decrease in agricultural-related and labor income, which would be considered an adverse effect. Mitigation Measure AG-1, described in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, would be available to reduce these effects by preserving agricultural productivity and compensating off-site."

EIR/EIS Page 16-20, L 32-36: "The recreation-oriented focus of the Delta leads to an interdependent relationship between the different businesses. Fishing guides and boaters depend on the marinas for supplies and fuel. Marinas without food services rely on local food markets or restaurants to serve visitors. Restaurants and wineries depend on hotels to provide accommodations for overnight or extended visits. All the businesses depend on visitors and tourists spending time and money in the Delta."

EIR/EIS Page 16-22, L 23-27: "Recreation-oriented activities in the Delta were estimated to contribute approximately $236.3 23 million in direct expenditures in 2010. These direct expenditures are expected to grow to approximately $256 million by 2020, $269.9 million by 2025, and $375.4 million by 2060. As shown in Table 16-12, boating activity accounts for the largest share of total recreation-related economic contributions in the Delta."

EIR/EIS Page 16-43, L 28-32: "Changes in employment and income associated with changes in recreation expenditures were not estimated using a regional IMPLAN model because direct changes in recreational expenditures have not been quantified."

COMMENT 2:

Alternative 4 and Alternative 9: The proposed mitigation for Agricultural employment losses is inadequate as the 190 operations and maintenance permanent jobs provided by the BDCP (EIR/EIS Page 30-43, L 29-30) in the Delta Counties is grossly insufficient to replace the significant permanent agriculture employment currently existing in the Delta. Per Table 16-8 (EIR/EIS Page 16-16) agriculture employment in 2011 was 25,100.

SUPPORTING INFORMATION/ASSESSMENT/MITIGATION MEASURE(S):

The Brattle Group Document(1), Page 3: "When interpreting our results, it is important to note that the project generates most jobs during the early phase of the Plan, while job losses from agricultural land retirement increase over time as the amount of retired land increases as a consequence of restoration. The time pattern of gains and losses is significant in that we have much more confidence in the near-term job estimates than in those forecasted decades in to the future."

COMMENT 3:

Alternative 4 and Alternative 9: The dewatering needed to construct the intake facilities and tunnels for both Alternative 4 and Alternative 9 will create significant adverse impacts on the

marinas throughout the Delta. Lack of consistent and ample water flows through the Delta will conceivably strand and/or landlock at least some, if not all, the marinas in the Delta. This holds true also with the boats and other watercraft which may be using the marinas and waterways. A study needs to be performed to analyze the impacts to the marinas and other water-based recreational businesses to determine the economic impacts. There would be approximately 10 marinas directly impacted which would be in the vicinity of the construction of the intake facilities and tunnels near Clarksburg and Walnut Grove. This would be an adverse impact.

SUPPORTING INFORMATION/ASSESSMENT/MITIGATION MEASURE(S):
EIR/EIS Page 14-121, L 26-28: "Localized effects related to dewatering activities in the vicinity of intake pump stations and the expanded Clifton Court Forebay would temporarily lower groundwater levels by up to 10 feet and 20 feet, respectively."

Per EIR/EIS Table 15-15 Recreation Sites Potentially Affected by Construction of Alternative 4, Wimpy's Marina (Page 15-253, L 13) is listed, but no other impacted marinas are identified. Other potentially impacted marinas include Snug Harbor Resort, Deckhands Marina, Walnut Grove Marina, New Hope Landing, Boat House Marina, Hidden Harbor, and Dagmar's among others. Please update Table 15-15 (Page 15-253, L 13) to include all impacted marinas and water-based recreational businesses and sites.

EIR/EIS Page 16-22, L 5-6: "The Delta recreation-related industries contribute about $5.8 billion in annual revenues, or about 9% of revenues for all industries . . ." EIR/EIS Page 16-22, L 26-27: "As shown in Table 16-12, boating activity accounts for the largest share of total recreation-related economic contributions in the Delta." As described in the above quotes, the loss of marinas and subsequent boating recreation, will have a significant adverse impact on the recreation economy of the Delta region. Because of the importance of the recreation economy to the total economic picture of the Delta, the lack of a definitive study on the recreation economy and lack of sufficient inclusion of this data in economic studies of the Delta makes all other data incorrect and thus irrelevant. The EIR/EIS BDCP document is not viable without inclusion of this information.

COMMENT 4:
Using IMPLAN for modeling is misleading because it cannot correctly identify the recreation components that need to be used to make educated decisions on economic impacts in the Delta due to the water conveyance construction. IMPLAN is being used for the regional economic and employment data to inform the EIR/EIS and per Jeffrey Michael, Professor at Eberhardt School of Business, "It is worth noting that there are well-known problems with applying a static input-output model such as IMPLAN to the types of long-run macroeconomic effects considered in this section of the Report . . ."(2) Either IMPLAN should be reconfigured to adequately model the full economic impacts of the Delta, including the full scope of recreation, or another model needs to be designed and implemented.

IMPACTS NOT CORRECT OR NOT IDENTIFIED and IMPACT DESIGNATIONS:

- Loss of recreation employment is not in the IMPLAN which accounts for inter-county spending patterns.
- All impacts are Adverse.

MITIGATION:

- There is no mitigation for loss of recreational income in the Delta including as noted in above Comment 1.
- There needs to be an assessment of the total number of jobs lost due to loss of recreation-oriented activities in the Delta and the number needs to be compared to the number of permanent positions provided by the BDCP (190).
- Mitigation for loss of agricultural jobs and income is inadequate, as the tunnel will not replace the $130 million crop value that the estimated loss of 100,000 acres would accrue yearly. This is based on the estimated $650 million crop value for 480,000 acres of Delta irrigated acres (EIR/EIS Page 16-51, L 24-25).

STUDIES/PAPERS/REFERENCES/DOCUMENTATION, ETC.:

(1) The Brattle Group's Paper "Employment Impacts for Proposed Bay Delta Water Conveyance Facility and Habitat Restoration, February 22, 2013, www.brattle.com.
(2) "Review of the Bay Delta conservation Plan Statewide Economic Impact Report, August 2013 draft," Dr. Jeffrey Michael, Page 14, last sentence.

BDCP 1754

Bay Delta Conservation Plan (BDCP) and Associated Draft Environmental Impact Report (EIR)/ Environmental Impact Statement (EIS) Comments

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Organization: North Delta C.A.R.E.S.

Date: July 28, 2014

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Document: EIR/EIS

Alternative 4—Dual Conveyance with Modified Pipeline/Tunnel and Intakes 2, 3, and 5 (9,000 cfs; Operational Scenario H) (16.3.3.9)
Alternative 4 would result in temporary effects on lands and communities associated with construction of three intakes and intake pumping plants, and other associated facilities; an intermediate forebay; conveyance pipelines; tunnels; an operable barrier at the head of Old River, and a new 600 acre Byron Tract Forebay, adjacent to and south of Clifton Court Forebay. Nearby areas would be altered as work or staging areas, concrete batch plants, fuel stations, or be used for spoils storage areas. Transmission lines, access roads, and other incidental facilities would also be needed for operations, and construction of these structures would also have effects on lands and communities.

Alternative 9—Through Delta/Separate Corridors (15,000 cfs; Operational Scenario G) (16.3.3.16)
Facilities constructed under Alternative 9 would include two fish-screened intakes along the Sacramento River near Walnut Grove, fourteen operable barriers, two pumping plants and other associated facilities, two culvert siphons, three canal segments, new levees, and new channel connections. Some existing channels would also be enlarged under this alternative. Nearby areas would be altered as work or staging areas or used for the deposition of spoils.

Chapter: 15-Recreation

Key Quote/Potential Impact:

EIS/EIR Impact Statement Executive Summary, Page ES-112
REC-2: Result in long-term reduction of recreation opportunities and experiences as a result of constructing the proposed water conveyance facilities.

COMMENT 5:

Alternative 4 and Alternative 9: Long term reduction of recreational opportunities due to construction of conveyance facilities (CM1). Construction of the Alt. 4 and Alt. 9 conveyance facilities would adversely impact well-established recreational and tourism opportunities and experiences in the area because of access, noise, and visual setting disruptions that could result in loss of public use.

BDCP 1754

The vital role the Sacramento-San Joaquin River Delta has played in the history of the formation of California is not adequately highlighted and evaluated in the Recreation Chapter. It is mentioned briefly in the Socioeconomics Chapter as well as the Recreation Chapter, but not extensively in either one. (See below excerpts.) This is a serious omission as the nine Legacy Towns are at the heart of California's history from the Gold Rush era to the present time. These are iconic towns, which need to be preserved and treasured for their historical value – and they are the towns that are most at risk of adverse impacts from the construction of the proposed water conveyance facilities, particularly the intake facilities proposed in Alternatives 4 and 9.

As these towns are in the North Delta, and the North Delta is where the main water conveyance facilities will be located, via Alternatives 4 and 9, these communities will either be directly eliminated (i.e. Hood), or the conveyance facility structures will destroy the historical ambiance by turning nearby areas into industrial construction zones during the initial approximate 10-year construction period, and massive concrete industrial water complexes following the construction (i.e. Walnut Grove, Clarksburg, Locke, etc.). This will compromise the traditional historical and legacy qualities that these towns represent, and thus eliminate a fundamental aspect of California's early history.

What has not been adequately represented in the Recreation chapter is that the Sacramento-San Joaquin River Delta is the heart of the history of California. These Legacy towns are the cornerstones of California's historical foundations dating back to the 1849 Gold Rush and California's adoption of Statehood in 1850. Walnut Grove, Freeport, Courtland, Clarksburg, and Isleton all date back to the mid-1800's. (See histories of the Delta Legacy Towns below.)

Recreation is not looked at in its totality. The approach of singling out only certain aspects of recreation in the Sacramento-San Joaquin River Delta, and evaluating these individually is inadequate. Particularly missing is full evaluation of the rich cultural heritage of the Delta, as well as its pivotal role in the exploration, development, and settlement of California.

The Sacramento River was the Interstate-5 (primary river highway) of California and brought the miners and explorers into the interior regions of California. Steamships transported miners from San Francisco to Sacramento as a starting point to the Gold Country in the Sierra Nevada Mountain foothills. The steamships also transported goods from San Francisco to support the miners as well as produce back to San Francisco from the rapidly developing agricultural production in the Sacramento-San Joaquin River Delta.

The Legacy Towns of Freeport, Clarksburg, Courtland, Hood, Walnut Grove, Locke, Ryde, Rio Vista, and Isleton were the primary towns and initial settlements supporting the miners and the farmers in the middle to late 1800's, beginning with the 1849 gold rush, just prior to California becoming a state in 1850.

In addition, Locke and Walnut Grove played a major historical role in supporting the Chinese engineers and Chinese immigrant laborers who designed and built much of the 1100 miles of Sacramento-San Joaquin River Delta levees.

Extensive studies are needed to evaluate the total holistic picture of recreation and tourism in the Sacramento-San Joaquin River Delta. Especially how it is affected by the Legacy Towns of Freeport, Clarksburg, Courtland, Hood, Walnut Grove, Locke, Ryde, Rio Vista and Isleton. A study of the loss of recreation and its related businesses is requested to be completed to determine the effects of the lost recreation and tourism industry and income to the Sacramento-San Joaquin River Delta as it relates to the overall water conveyance construction and activities.

www.sacramentoriverdeltagrown.com (See attached map)

www.deltaheartbeattour.com (See attached map)

Map: California Delta Boaters Map and Visitors Guide – NOAA Waterway Data and USGS Land Layout – California Delta Chamber of Commerce – 2014

SUPPORTING INFORMATION/ASSESSMENT

- "Legacy," as in "Legacy Town" is defined as "one from a previous time that has influence now" and "anything handed down from the past, as from an ancestor or predecessor," per www.yourdictionary.com/legacy.

- **EIR/EIS Page 16-21, L 7-9:** The Socioeconomics Chapter 16 states "Heritage tourism involves traveling to experience an area's historic, cultural, and natural resources (National Trust for Historic Preservation 2010). Examples include visits to historic sites, national and state parks, museums, festivals, and other cultural events (D. K.Shiflett and Associates 2000)." Socioeconomics Chapter 16 **EIR/EIS Page 16-21, L 10-12 a**lso states: "Heritage tourism in the Delta occurs in small historic towns along the Sacramento River that developed as steamboat landings during the Gold Rush. Freeport, Clarksburg, Hood, Courtland, Locke, Walnut Grove, Ryde, Isleton and Rio Vista are all considered legacy towns."

- The Recreation Chapter, under Visiting Historic Sites **(Page 15-7, L 1-11)**, states that "The Delta has a long and varied history of human use and, therefore, has many historic sites, several of which are associated with legacy towns, such as Isleton, Locke, and Walnut Grove. (The term "legacy town" is applied to several small, historic towns along the Sacramento River in the Delta that were originally established as riverboat ports.) Self-guided walks, available in both Locke and Walnut Grove, take visitors past old sites and buildings, including residences, a market, gambling museum, blacksmith shop, butcher shop, and bank. Visitors can stop at historic sites in the Delta year-round. DPR [Department of Parks and Recreation] and the Sacramento Housing and Redevelopment

Agency have restored a former Chinese immigrant boarding house in Locke to preserve its history (Reyman Construction 2011). The project also includes a visitor's center and interpretative exhibits within the boarding house (Locke Foundation 2012)."

- California's 1849 Gold Rush prompted the rise of the legacy settlements in the Sacramento-San Joaquin River Delta. **According to Wikipedia**, the 1848-49 "Gold Rush propelled California from a sleepy, little-known backwater to a center of the global imagination and the destination of hundreds of thousands of people." "It is estimated that approximately 90,000 people arrived in California in 1849—about half by land and half by sea. "In the midst of the Gold Rush, towns and cities were chartered, a state constitutional convention was convened, a state constitution written, elections held, and representatives sent to Washington, D.C. to negotiate the admission of California as a state." (https://en.wikipedia.org/wiki/California_Gold_Rush)

  San Francisco also came into its own during this time. Wikipedia also states that "between 1847 and 1870, the population of San Francisco increased from 500 to 150,000." "Within California, the first steamship, the SS California (1848), showed up on February 28, 1849. Soon steamships were carrying miners the 125 miles (201 km) up the Sacramento River to Sacramento, California." "Agriculture and ranching expanded throughout the state to meet the needs of the settlers." "Large-scale agriculture (California's second "Gold Rush") began during this time." **(https://en.wikipedia.org/wiki/California_Gold_Rush)**

- **The Delta Reform Act of 2009** designated a number of unincorporated legacy communities in the Delta including Freeport, Clarksburg, Courtland, Hood, Locke, Walnut Grove, Isleton, and Rio Vista, as well as Bethel Island and Knightsen. These communities exemplify the Delta's unique cultural history and contribute to the sense of the Delta as a place. They enjoy colorful history, and coupled with the river recreation and wine tasting region, this area is the next tourism draw for the Sacramento area.
- The goals of the Bay Delta Conservation Plan are "providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem. The co-equal goals shall be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place."

- **Legacy Towns in the North Sacramento-San Joaquin River Delta Include:**
  - **Freeport, Est. 1862**: "Nearly all goods traveling to Sacramento and the Gold Rush came by boat from the Bay Area. In the early 1860s businessmen grew tired of paying taxes at the Sacramento Embarcadero (port). In 1862 Freeport Railroad Company was created with the idea of building a new port that was free of taxes.[2] Hence 'Freeport.' The idea was to build a railway that bypassed Sacramento connecting with the Sacramento Valley Railroad at a midway point between Sacramento and Folsom. The newly formed town boomed for three years with populations reaching 300-400."(1)

- **Clarksburg, Est. 1876:** Clarksburg has been settled in stages dating back as early as the 1850s when Merritt Island was first cleared and developed for agricultural uses. Postal authorities first established a post office in 1876, under the name "Clarksburgh" and changed the name to "Clarksburg" in 1893.[3] The town was named after Robert C. Clark who settled at the place in 1849.[3] In the 1920s the New Holland Land Company began subdividing the tracts in the area and formally established Clarksburg as an unincorporated community. **Clarksburg is unique among small California towns in that many of the families who initially settled the area are still present, thus lending a small-town charm to the community.** A portion of the original Old Sugar Mill is now home to a modern wine tasting and production facility. **The Bogle Winery on Merritt Island has become the most famous of the Clarksburg appellation vintners with their wines being sold worldwide and being served at the White House as of 2007.** The population in 2008 is approximately 300. This is an approximation as the community borders are undefined and opinions on what outlying areas are actually part of Clarksburg vary from one source to the next. The portion of Sacramento County directly across the Sacramento River was once considered part of the community due to the ferry crossing that existed at Clarksburg from 1920 until the Freeport Bridge opened on New Year's Day in 1930. The ferry itself sank in November, 1928. Some of the older members of the community still refer to that adjoining area of Sacramento County as Clarksburg for that reason. Clarksburg has a thriving grade school, middle school and high school that has students from all over the region, including West Sacramento. There are two churches, a United Church of Christ community church and a Catholic Church, both very well attended. The Catholic Church has three services every Sunday. There is a post office, community grocery store, and public library. The town enjoys tourism through the new Clarksburg Wine Appellation and there are approximately 30 wineries in the region today many offering wine tasting and tours of their facilities. The climate is excellent for wine grapes, **and Bogle Winery has been featured as selling the most wine in the Western Hemisphere at Sacramento's United Wine Symposium in 2013**."(1)
- **Hood, Est. 1912:** "The community was named in 1910 after William Hood, chief engineer of the Southern Pacific Railroad.[4] The population was 271 at the 2010 census. Hood still has one of the original cold storage packing sheds that sits on the Sacramento River and was used to store produce until picked up or dropped off by steamboat or rail."(2)
- **Courtland, Est. 1872:** "Courtland was named after Courtland Sims, son of James V. Sims, a landowner who opened a steamer landing in the community in 1870 (4) Courtland was once the Pear Capital of the world and celebrates this the last Sunday in July every year by hosting a community Pear Fair."(3)
- **Walnut Grove, Est. 1850:** "Walnut Grove is one of the earliest settlements along the Sacramento River. The town quickly prospered as an agricultural center and riverboat stop (the forests were timbered for steamboat firewood) and a major shipping port by 1865 for agricultural produce, and fish, with the Bartlett Pear as its

primary product. By 1870, it was a thriving town full of small businesses, a school, post office, and Union Guard Armory. Ferry service operated for many years between parts of town on either side of the river until the first bridge was opened in 1916. The bridge, since replaced by a modern span, was the first cantilevered counter-weight bascule drawbridge constructed west of the Mississippi River. It was officially opened by the Governor of California who traveled with various dignitaries to Walnut Grove on the gubernatorial yacht. As early as 1914, a large Japanese community lived in Walnut Grove. About 67 Japanese-owned businesses (with names and addresses) are listed in the Nichi-Bei Nenkan (Japanese American Yearbook) of 1914 - including one tofu shop - Sakai Tofu-ya. There was still a tofu shop in town in 1975, according to The Book of Tofu.(4) The community was racially segregated up to the start of World War II. Only whites were allowed to own homes on the West side of the river. Even on the East side, the Asians separated into a Japanese section and a Chinese section. There were two elementary schools [a 'white' school and Walnut Grove Oriental Elementary] until the Japanese were forcefully moved out of the area at the start of World War II. Then, the two elementary schools [up to Grade 8] were combined. After elementary school, the students were bussed to Courtland for high school until that school became identified as an earthquake hazard. (5)

- **Locke, Est. 1915:** Locke is one of the only towns in the United States built entirely by Chinese. It was built in 1915 and burned down twice. Locke was a bustling place with gambling houses, merchant stores and a movie house all owned by the Chinese. Locke today is much like it was many years ago. Most of the original buildings are still standing. The Chinese residents were immigrants from two different area from the Delta region in Guangdong [Canton] China (It is worthy to note that the Chinese engineers from Canton China were from the Pearl River Valley and it was actually these experienced Chinese engineers who designed the levees and they were built from these designs. Many of these Chinese engineers returned to China) The Chung Shan[*disambiguation needed*] people resided in Locke, while Walnut Grove was populated by immigrants from Toi Shan county in China. During the Sino-Japanese War in the 1930s, the Walnut Grove-Locke-Isleton area was a prime target for visiting Chinese government VIPs to raise funds for the Chinese government. It was listed on the National Register of Historic Places in 1971 and further was designated a National Historic Landmark District in 1990 due to its unique example of a historic Chinese American rural community. (6)
- **Ryde, Est.1892:** Ryde is best known for The Ryde Hotel. It is an interesting tourist attraction where they serve bottomless champagne Sunday brunch. The hotel does meetings, events, and is open for overnight lodging. The Ryde Hotel was built in 1927 at the peak of the prohibition era. It was an opulent establishment, complete with beauty salon and barber shop that served as a riverboat way station. It was also rumored to be a bordello. The lower level was a speakeasy, offering bootleg whisky and jazz to a clientele in search of a good time.

There was even a trap door in the floor that allegedly opened to reveal a tunnel running under the road to a hidden doorway at the river's edge. The Ryde attracted celebrities of all types from President Herbert Hoover to local and state politicians to movie stars and mobsters. (7)

- **Isleton, Est. 1876:** Chinese began immigrating to Isleton around 1875, and at its peak, the Chinese population numbered approximately 1,500.The city has many preserved 19th-century era storefronts along its main street, some of which show distinct Chinese influences. Chinatown, and the many façade front buildings, still remains intact. The very appeal of a bygone era still reminds residents and visitors of what was once referred to as "the Little Paris of the Delta." Many cultures still inhabit Isleton today as they did then.(8)
- **Rio Vista, Est. 1893:** The present location of Rio Vista is several miles south of the original settlement. Colonel Nathan H. Davis founded "Brazos del Rio" near the entrance of Cache Slough at the Sacramento River, on the Rancho Los Ulpinos Mexican land grant, in 1858. The settlement was renamed "Rio Vista" before a flood in 1862 that resulted in the town moving to its present location on higher ground. The city's name combines the Spanish words for "river" and "view." Post authorities established office in 1858.[5] The community was officially incorporated as Rio Vista on December 30, 1893. Rio Vista was visited by a lost humpback whale in 1985, despite being 60 miles (100 kilometers) upriver from the Pacific Ocean. The young whale, nicknamed "Humphrey", attracted throngs of curiosity seekers before he was eventually guided back to sea by rescuers. Again in May 2007, humpbacks were sighted in Rio Vista. "Delta" and "Dawn," mother and calf, stopped at least twice in the river near the town.(9)

IMPACTS NOT CORRECT OR NOT IDENTIFIED and IMPACT DESIGNATIONS:

- There is negligible mention of the extreme historical value of the Legacy Towns in the Sacramento-San Joaquin River Delta. These towns are the cornerstones of California's historical foundations dating back to the 1849 Gold Rush and California's adoption of Statehood in 1850. Walnut Grove, Freeport, Courtland, Clarksburg, and Isleton all date back to the mid-1800's.
- Mitigation does not satisfactorily address impacts to the Legacy Towns and other tourist locations, thus all impacts are Adverse/Significant and Unavoidable.

MITIGATION:

- Mitigation is not adequate to address impacts on all recreation in the Sacramento-San Joaquin River Delta, including tourism and agritourism, and does not sufficiently and effectively address the loss of tourism, historical significance and other recreational aspects related to the Legacy Towns of the Delta.
- There is no mitigation for loss of recreational and tourism income in the Sacramento-San Joaquin River Delta with the construction of the proposed water conveyance facilities.

BDCP 1754

STUDIES/PAPERS/REFERENCES/DOCUMENTATION, ETC.:

(1)Gudde, Erwin G.; Bright, William (2004-05-10). *California Place Names: The Origin and Etymology of Current Geographical Names*. University of California Press. p. 137. ISBN 978-0-520-24217-3. Retrieved 27 April 2011

(2) Durham, David L. (1998). *California's Geographic Names: A Gazetteer of Historic and Modern Names of the State*. Quill Driver Books. p. 466. ISBN 9781884995149

(3) Durham, David L. (1998). *California's Geographic Names: A Gazetteer of Historic and Modern Names of the State*. Quill Driver Books. p. 499. ISBN 9781884995149

(4) Durham, David L. (1998). *California's Geographic Names: A Gazetteer of Historic and Modern Names of the State*. Quill Driver Books. p. 471. ISBN 9781884995149.

(5) American FactFinder". United States Census Bureau. Retrieved 2008-01-31.

(6) It was listed on the National Register of Historic Places in 1971 and further was designated a National Historic Landmark District in 1990 due to its unique example of a historic Chinese American rural community.

(7) http://www.rydehotel.com/html/history.html

(8) http://www.isletoncoc.org/

(9) Place-Names of the San Francisco Bay Area, David L. Durham, ISBN 1-884995-35-7

BDCP 1754

Bay Delta Conservation Plan (BDCP) and Associated Draft Environmental Impact Report (EIR)/ Environmental Impact Statement (EIS) Comments

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Document: EIR/EIS

Alternative 4—Dual Conveyance with Modified Pipeline/Tunnel and Intakes 2, 3, and 5 (9,000 cfs; Operational Scenario H) (16.3.3.9)
Alternative 4 would result in temporary effects on lands and communities associated with construction of three intakes and intake pumping plants, and other associated facilities; an intermediate forebay; conveyance pipelines; tunnels; an operable barrier at the head of Old River, and a new 600 acre Byron Tract Forebay, adjacent to and south of Clifton Court Forebay. Nearby areas would be altered as work or staging areas, concrete batch plants, fuel stations, or be used for spoils storage areas. Transmission lines, access roads, and other incidental facilities would also be needed for operations, and construction of these structures would also have effects on lands and communities.

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Chapter: 15-Recreation

Key Quote/Potential Impact:

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  San Francisco also came into its own during this time. Wikipedia also states that "between 1847 and 1870, the population of San Francisco increased from 500 to 150,000." "Within California, the first steamship, the SS California (1848), showed up on February 28, 1849. Soon steamships were carrying miners the 125 miles (201 km) up the Sacramento River to Sacramento, California." "Agriculture and ranching expanded throughout the state to meet the needs of the settlers." "Large-scale agriculture (California's second "Gold Rush") began during this time." **(https://en.wikipedia.org/wiki/California_Gold_Rush)**

- **The Delta Reform Act of 2009** designated a number of unincorporated legacy communities in the Delta including Freeport, Clarksburg, Courtland, Hood, Locke, Walnut Grove, Isleton, and Rio Vista, as well as Bethel Island and Knightsen. These communities exemplify the Delta's unique cultural history and contribute to the sense of the Delta as a place. They enjoy colorful history, and coupled with the river recreation and wine tasting region, this area is the next tourism draw for the Sacramento area.
- The goals of the Bay Delta Conservation Plan are "providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem. The co-equal goals shall be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place."

- **Legacy Towns in the North Sacramento-San Joaquin River Delta Include:**
  - **Freeport, Est. 1862**: "Nearly all goods traveling to Sacramento and the Gold Rush came by boat from the Bay Area. In the early 1860s businessmen grew tired of paying taxes at the Sacramento Embarcadero (port). In 1862 Freeport Railroad Company was created with the idea of building a new port that was free of taxes.[2] Hence 'Freeport.' The idea was to build a railway that bypassed Sacramento connecting with the Sacramento Valley Railroad at a midway point between Sacramento and Folsom. The newly formed town boomed for three years with populations reaching 300-400."(1)

- **Clarksburg, Est. 1876:** Clarksburg has been settled in stages dating back as early as the 1850s when Merritt Island was first cleared and developed for agricultural uses. Postal authorities first established a post office in 1876, under the name "Clarksburgh" and changed the name to "Clarksburg" in 1893.[3] The town was named after Robert C. Clark who settled at the place in 1849.[3] In the 1920s the New Holland Land Company began subdividing the tracts in the area and formally established Clarksburg as an unincorporated community. **Clarksburg is unique among small California towns in that many of the families who initially settled the area are still present, thus lending a small-town charm to the community.** A portion of the original Old Sugar Mill is now home to a modern wine tasting and production facility. **The Bogle Winery on Merritt Island has become the most famous of the Clarksburg appellation vintners with their wines being sold worldwide and being served at the White House as of 2007.** The population in 2008 is approximately 300. This is an approximation as the community borders are undefined and opinions on what outlying areas are actually part of Clarksburg vary from one source to the next. The portion of Sacramento County directly across the Sacramento River was once considered part of the community due to the ferry crossing that existed at Clarksburg from 1920 until the Freeport Bridge opened on New Year's Day in 1930. The ferry itself sank in November, 1928. Some of the older members of the community still refer to that adjoining area of Sacramento County as Clarksburg for that reason. Clarksburg has a thriving grade school, middle school and high school that has students from all over the region, including West Sacramento. There are two churches, a United Church of Christ community church and a Catholic Church, both very well attended. The Catholic Church has three services every Sunday. There is a post office, community grocery store, and public library. The town enjoys tourism through the new Clarksburg Wine Appellation and there are approximately 30 wineries in the region today many offering wine tasting and tours of their facilities. The climate is excellent for wine grapes, **and Bogle Winery has been featured as selling the most wine in the Western Hemisphere at Sacramento's United Wine Symposium in 2013**."(1)
- **Hood, Est. 1912:** "The community was named in 1910 after William Hood, chief engineer of the Southern Pacific Railroad.[4] The population was 271 at the 2010 census. Hood still has one of the original cold storage packing sheds that sits on the Sacramento River and was used to store produce until picked up or dropped off by steamboat or rail."(2)
- **Courtland, Est. 1872:** "Courtland was named after Courtland Sims, son of James V. Sims, a landowner who opened a steamer landing in the community in 1870 (4) Courtland was once the Pear Capital of the world and celebrates this the last Sunday in July every year by hosting a community Pear Fair."(3)
- **Walnut Grove, Est. 1850:** "Walnut Grove is one of the earliest settlements along the Sacramento River. The town quickly prospered as an agricultural center and riverboat stop (the forests were timbered for steamboat firewood) and a major shipping port by 1865 for agricultural produce, and fish, with the Bartlett Pear as its

primary product. By 1870, it was a thriving town full of small businesses, a school, post office, and Union Guard Armory. Ferry service operated for many years between parts of town on either side of the river until the first bridge was opened in 1916. The bridge, since replaced by a modern span, was the first cantilevered counter-weight bascule drawbridge constructed west of the Mississippi River. It was officially opened by the Governor of California who traveled with various dignitaries to Walnut Grove on the gubernatorial yacht. As early as 1914, a large Japanese community lived in Walnut Grove. About 67 Japanese-owned businesses (with names and addresses) are listed in the Nichi-Bei Nenkan (Japanese American Yearbook) of 1914 - including one tofu shop - Sakai Tofu-ya. There was still a tofu shop in town in 1975, according to The Book of Tofu.(4) The community was racially segregated up to the start of World War II. Only whites were allowed to own homes on the West side of the river. Even on the East side, the Asians separated into a Japanese section and a Chinese section. There were two elementary schools [a 'white' school and Walnut Grove Oriental Elementary] until the Japanese were forcefully moved out of the area at the start of World War II. Then, the two elementary schools [up to Grade 8] were combined. After elementary school, the students were bussed to Courtland for high school until that school became identified as an earthquake hazard. (5)

- **Locke, Est. 1915:** Locke is one of the only towns in the United States built entirely by Chinese. It was built in 1915 and burned down twice. Locke was a bustling place with gambling houses, merchant stores and a movie house all owned by the Chinese. Locke today is much like it was many years ago. Most of the original buildings are still standing. The Chinese residents were immigrants from two different area from the Delta region in Guangdong [Canton] China (It is worthy to note that the Chinese engineers from Canton China were from the Pearl River Valley and it was actually these experienced Chinese engineers who designed the levees and they were built from these designs. Many of these Chinese engineers returned to China) The Chung Shan[*disambiguation needed*] people resided in Locke, while Walnut Grove was populated by immigrants from Toi Shan county in China. During the Sino-Japanese War in the 1930s, the Walnut Grove-Locke-Isleton area was a prime target for visiting Chinese government VIPs to raise funds for the Chinese government. It was listed on the National Register of Historic Places in 1971 and further was designated a National Historic Landmark District in 1990 due to its unique example of a historic Chinese American rural community. (6)
- **Ryde, Est.1892:** Ryde is best known for The Ryde Hotel. It is an interesting tourist attraction where they serve bottomless champagne Sunday brunch. The hotel does meetings, events, and is open for overnight lodging. The Ryde Hotel was built in 1927 at the peak of the prohibition era. It was an opulent establishment, complete with beauty salon and barber shop that served as a riverboat way station. It was also rumored to be a bordello. The lower level was a speakeasy, offering bootleg whisky and jazz to a clientele in search of a good time.

There was even a trap door in the floor that allegedly opened to reveal a tunnel running under the road to a hidden doorway at the river's edge. The Ryde attracted celebrities of all types from President Herbert Hoover to local and state politicians to movie stars and mobsters. (7)

- **Isleton, Est. 1876:** Chinese began immigrating to Isleton around 1875, and at its peak, the Chinese population numbered approximately 1,500.The city has many preserved 19th-century era storefronts along its main street, some of which show distinct Chinese influences. Chinatown, and the many façade front buildings, still remains intact. The very appeal of a bygone era still reminds residents and visitors of what was once referred to as "the Little Paris of the Delta." Many cultures still inhabit Isleton today as they did then.(8)
- **Rio Vista, Est. 1893:** The present location of Rio Vista is several miles south of the original settlement. Colonel Nathan H. Davis founded "Brazos del Rio" near the entrance of Cache Slough at the Sacramento River, on the Rancho Los Ulpinos Mexican land grant, in 1858. The settlement was renamed "Rio Vista" before a flood in 1862 that resulted in the town moving to its present location on higher ground. The city's name combines the Spanish words for "river" and "view." Post authorities established office in 1858.[5] The community was officially incorporated as Rio Vista on December 30, 1893. Rio Vista was visited by a lost humpback whale in 1985, despite being 60 miles (100 kilometers) upriver from the Pacific Ocean. The young whale, nicknamed "Humphrey", attracted throngs of curiosity seekers before he was eventually guided back to sea by rescuers. Again in May 2007, humpbacks were sighted in Rio Vista. "Delta" and "Dawn," mother and calf, stopped at least twice in the river near the town.(9)

IMPACTS NOT CORRECT OR NOT IDENTIFIED and IMPACT DESIGNATIONS:

- There is negligible mention of the extreme historical value of the Legacy Towns in the Sacramento-San Joaquin River Delta. These towns are the cornerstones of California's historical foundations dating back to the 1849 Gold Rush and California's adoption of Statehood in 1850. Walnut Grove, Freeport, Courtland, Clarksburg, and Isleton all date back to the mid-1800's.
- Mitigation does not satisfactorily address impacts to the Legacy Towns and other tourist locations, thus all impacts are Adverse/Significant and Unavoidable.

MITIGATION:

- Mitigation is not adequate to address impacts on all recreation in the Sacramento-San Joaquin River Delta, including tourism and agritourism, and does not sufficiently and effectively address the loss of tourism, historical significance and other recreational aspects related to the Legacy Towns of the Delta.
- There is no mitigation for loss of recreational and tourism income in the Sacramento-San Joaquin River Delta with the construction of the proposed water conveyance facilities.

BOCR 1754

STUDIES/PAPERS/REFERENCES/DOCUMENTATION, ETC.:

(1)Gudde, Erwin G.; Bright, William (2004-05-10). *California Place Names: The Origin and Etymology of Current Geographical Names*. University of California Press. p. 137. ISBN 978-0-520-24217-3. Retrieved 27 April 2011

(2) Durham, David L. (1998). *California's Geographic Names: A Gazetteer of Historic and Modern Names of the State*. Quill Driver Books. p. 466. ISBN 9781884995149

(3) Durham, David L. (1998). *California's Geographic Names: A Gazetteer of Historic and Modern Names of the State*. Quill Driver Books. p. 499. ISBN 9781884995149

(4) Durham, David L. (1998). *California's Geographic Names: A Gazetteer of Historic and Modern Names of the State*. Quill Driver Books. p. 471. ISBN 9781884995149.

(5) American FactFinder". United States Census Bureau. Retrieved 2008-01-31.

(6) It was listed on the National Register of Historic Places in 1971 and further was designated a National Historic Landmark District in 1990 due to its unique example of a historic Chinese American rural community.

(7) http://www.rydehotel.com/html/history.html

(8) http://www.isletoncoc.org/

(9) Place-Names of the San Francisco Bay Area, David L. Durham, ISBN 1-884995-35-7

BDCP 1754

Bay Delta Conservation Plan (BDCP) and Associated Draft Environmental Impact Report (EIR)/ Environmental Impact Statement (EIS) Comments

Name: Kim Glazzard

Organization:

Date:

Address: _____ _____ _____ _____
(Address) (City) (State) (Zip Code)

Document: EIR/EIS

Chapter: 19-Transportation

Key Quote/Potential Impact:

EIS/EIR Executive Summary Trans-2, **page ES-121** and Table 19-7 :

> TRANS-2: Increased construction vehicle trips exacerbating unacceptable pavement conditions

Comments/Questions (Including Inadequacies, Contradictions, Unidentified Impacts, Incomplete Information, etc.):

Comment 1:
During construction of Alt. 4, load-bearing trucks would damage roadway surfaces, contributing to deterioration of existing pavement conditions to a less than acceptable threshold on a total of 43 roadway segments identified in Table 9-7 **(pages 19-37 to 19-39)**. In addition, damage to roadway pavement is expected to occur throughout the study area (Figure 9-4, page) on various local and state roads, as well as on a few interstates. If use of physically deficient roadways cannot be avoided or limited, it may be necessary to improve the deficient roadways identified in Table 19-26 (**pages 19-177 to 19-180**), or make other necessary infrastructure improvements before construction to make them suitable for use during construction.

BDCP 1754

Comment 2:
Although Mitigation Measures TRANS-2a through TRANS-2c would reduce the severity, but not necessarily to less than significant levels as BDCP proponents can not ensure that the agreements or encroachment permits will be obtained from the relevant transportation agencies. This is a significant and unavoidable impact. **(Page 19-164.)**

- Prior to construction, BDCP proponents will make a "good faith" effort to enter into Mitigation Agreements with affected state, regional, or local agencies to verify the location, extent, timing, and "fair share" cost to be paid by the BDCP proponents for any necessary pre- and post-construction physical improvements. Mitigation Measure TRANS-2a thru TRANS-2c are available to reduce this effect, but not necessarily to a level that would not be adverse because BDCP proponents cannot ensure that agreements or encroachment permits will be obtained from the relevant transportation agencies, so impact is significant and unavoidable if can't obtain.
- This borders on extortion to condition BDCP proponent's financial responsibility for mitigation of damage caused by their project on whether a local government agency signs a Mitigation Agreement. To avoid the costs of mitigation of their impacts, all BDCP proponents have to do is declare the local agency didn't negotiate in "good faith" and therefore couldn't reach agreement, leaving full financial burden on local government for BDCP's project damage.
- Per Table 19-1 **(pages 19-2 to 19-6)** of the 83 total identified roadway study segments 42 are in Sacramento County. Table 19-5 **(pages 19-15 to 19-21)** identifies that 41 of those 42 roadway study segments in Sacramento County are already LOS. Should the scenario in the above paragraph play out, this will cause extreme hardship and place a severe financial burden on Sacramento County.

Supporting Information/Assessment/Mitigation Measure(s):

-

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- From TRANS-1 (below are examples)
- Narrow levee roads – no room to pull over. References to Transportation Management Plans to address narrow levee roads are listed on **pages 19-173 to 19-175** in the event of emergency vehicles on the roadway. However no mention is made of how to address accommodations for transportation of agricultural equipment and school busses that need to pick up children at their homes. Roadways are often used by agricultural trucks and haulers, including tractors of various sizes, to get from field to field, to transport crops and produce, as well as to move spraying equipment. School busses in the areas of construction in the Primary Zone historically pick up and drop off children at their homes on school days.
- Plan should identify how many construction trucks will be added to roads on a daily basis.
- Local agriculture equipment can't compete with large construction vehicles.
- Increased traffic volumes, particularly with wide trucks on narrow levee roads, increase the risk of care accidents and fatalities.
- Mitigation needs to be identified regarding school bus stops and safety of children.

Studies/Papers/Reference/Documentation, etc.:

BDCP 1754

Bay Delta Conservation Plan (BDCP) and Associated Draft Environmental Impact Report (EIR)/ Environmental Impact Statement (EIS) Comments

Name:

Organization:

Date:

Address: _____ _____ _____ _____
(Address) (City) (State) (Zip Code)

Document: EIR/EIS

Chapter: 19-Transportation

Key Quote/Potential Impact:

EIS/EIR Executive Summary Trans-3, **page ES-121** and Table 19-7 :

> TRANS-3: Increase in safety hazards, including interference with emergency routes during construction

Comments/Questions (Including Inadequacies, Contradictions, Unidentified Impacts, Incomplete Information, etc.):

Comment 1:
Increase in roadway safety hazards and interference with emergency routes during conveyance construction. Alternative 4 would require a heavy volume of materials to be hauled to and from construction work zones, increases potential for vehicle accidents due to the increased amount of heavy trucks using the local roads and highways, creating conflicts with: recreational and commuter traffic; farming operations; and emergency service vehicles and response times. If an improvement identified in the TRANS-1c Mitigation Agreement is not fully funded and constructed before the project's contribution to the increased safety hazard is made, then impact is significant and unavoidable. **(Pages 19-183, lines 22-28.)**

During construction of Alt. 4, load-bearing trucks would damage roadway surfaces, contributing to deterioration of existing pavement conditions to a less than acceptable threshold on a total of 43 roadway segments identified in Table 9-7 **(pages 19-37 to 19-39)**. In addition, damage to roadway pavement is expected to occur throughout the study area (Figure 9-4, page) on various local and state roads, as well as on a few interstates. If use of physically deficient roadways cannot be avoided or limited, it may be necessary to improve the deficient roadways identified in Table 19-26 (**pages 19-177 to 19-180**), or make other necessary infrastructure improvements before construction to make them suitable for use during construction.

Comment 2:
Although Mitigation Measures TRANS-2a through TRANS-2c would reduce the severity, but not necessarily to less than significant levels as BDCP proponents can not ensure that the agreements or encroachment permits will be obtained from the relevant transportation agencies. This is a significant and unavoidable impact. **(Page 19-164.)**

- Prior to construction, BDCP proponents will make a "good faith" effort to enter into Mitigation Agreements with affected state, regional, or local agencies to verify the location, extent, timing, and "fair share" cost to be paid by the BDCP proponents for any necessary pre- and post-construction physical improvements. Mitigation Measure TRANS-2a thru TRANS-2c are available to reduce this effect, but not necessarily to a level that would not be adverse because BDCP proponents cannot ensure that agreements or encroachment permits will be obtained from the relevant transportation agencies, so impact is significant and unavoidable if can't obtain.
- This borders on extortion to condition BDCP proponent's financial responsibility for mitigation of damage caused by their project on whether a local government agency signs a Mitigation Agreement. To avoid the costs of mitigation of their impacts, all BDCP proponents have to do is declare the local agency didn't negotiate in "good faith" and therefore couldn't reach agreement, leaving full financial burden on local government for BDCP's project damage.
- Per Table 19-1 **(pages 19-2 to 19-6)** of the 83 total identified roadway study segments 42 are in Sacramento County. Table 19-5 **(pages 19-15 to 19-21)** identifies that 41 of those 42 roadway study segments in Sacramento County are already LOS. Should the scenario in the above paragraph play out, this will cause extreme hardship and place a severe financial burden on Sacramento County.

Supporting Information/Assessment/Mitigation Measure(s):

- Narrow levee roads – no room to pull over. References to Transportation Management Plans to address narrow levee roads are listed on **pages 19-173 to 19-175** in the event of emergency vehicles on the roadway. However no mention is made of how to address accommodations for transportation of agricultural equipment and school busses that need to pick up children at their homes. Roadways are often used by agricultural trucks and haulers, including tractors of various sizes, to get from field to field, to transport crops and produce, as well as to move spraying equipment. School busses in the areas of construction in the Primary Zone historically pick up and drop off children at their homes on school days.
- Plan should identify how many construction trucks will be added to roads on a daily basis.
- Local agriculture equipment can't compete with large construction vehicles.
- Increased traffic volumes, particularly with wide trucks on narrow levee roads, increase the risk of care accidents and fatalities.
- Mitigation needs to be identified regarding school bus stops and safety of children.

Studies/Papers/Reference/Documentation, etc.:

BDCP 1754

Bay Delta Conservation Plan (BDCP) and Associated Draft Environmental Impact Report (EIR)/ Environmental Impact Statement (EIS) Comments

Name: Kim Glazzard

Organization:

Date:

Address: _____ _____ _____ _____
(Address) (City) (State) (Zip Code)

Document: EIR/EIS

Chapter: 19-Transportation

Key Quote/Potential Impact:

EIS/EIR Executive Summary Trans-1, page ES-121:

> TRANS-1: Increased construction vehicle trips resulting in unacceptable Level Of Service (LOS) conditions

Comments/Questions (Including Inadequacies, Contradictions, Unidentified Impacts, Incomplete Information, etc.):

Comment 1:
(Table 19-3, pages 19-8 to 19-12 and Table 19-25, pages 19-165 to 19-172.)
The number of vehicles generated by construction activities under Alt. 4 would exacerbate already unacceptable traffic flows by exceeding acceptable traffic volume levels on 33 roadway segments for at least one hour between 6:00 a.m. and 7:00 p.m., thereby exacerbating already unacceptable conditions. This is an adverse and significant and unavoidable impact. **MITIGATION: In order to reduce the disruption created by the construction of multiple intakes at one time, I request that you reduce the construction to one intake built at a time and tested first before constructing any additional intakes – and only add more intakes if all limits are met.**

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Comment 2:
(Page 19-164, lines 23-26)
The highest concentration of roadway segments to have traffic volumes exceeded include: SR-12; I-80; SR-4; I-205; as well as thresholds being exceeded on several local roadways and all segments studied in West Sacramento.

- **(Page 19-164, lines 33-38)**
  Although Mitigation Measures TRANS-1a through TRANS-1c would reduce the severity, BDCP proponents are not solely responsible for the timing, nature, or complete funding of required improvements. This is an adverse and significant and unavoidable impact.
  - It is likely BDCP proponents will make a "good faith" effort to enter into Mitigation Agreements with affected state, regional, or local agencies to verify the location, extent, timing, and "fair share" cost to be paid for "capacity enhancements" to the identified roadway segments in Table 19-9 **(pages 19-55 to 19-59)**. BDCP proponents will only be responsible for their "fair share costs" of all "feasible capacity-expanding" improvements determined to be "necessary, feasible, and available." If an improvement identified in any Mitigation Agreement(s) contemplated by Mitigation Measure TRANS-1c **(page ES-121)** is not fully funded and constructed before the project's contribution to the effect is made, the impact would be adverse and significant and unavoidable. **(Page 19-164, lines 33-38 and page 19-175, lines 12-40 and page 19-176, lines 1-35.)**
  - This possibly borders on extortion to withholding mitigation for the project's impacts unless the county signs a Mitigation Agreement committing them to pay for a portion of roadway improvements that would not be needed or occurring, if not for the increased "capacity" created by CM1 conveyance construction truck volume. By definition "capacity-expanding physical improvements" are only need in order to accommodate the increased traffic volume of BDCP construction trucks and is therefore 100% financial responsibility of BDCP proponents. To avoid the costs of mitigation of their impacts, all BDCP proponents have to do is declare the local agency didn't negotiate in "good faith" and therefore couldn't reach agreement, leaving full financial burden on local government for BDCP's project damage.
  - Per Table 19-5 **(pages 19-15 to 19-21),** there are 113 total identified roadway study segments and per Table 19-5 **(pages 19-15 to 19-21)** 83 of those segments are already deficient.

  - Per Table 19-1 **(pages 19-2 to 19-6)** of the 83 total identified roadway study segments 42 are in Sacramento County. Table 19-5 **(pages 19-15 to 19-21)** identifies that 41 of those 42 roadway study segments in Sacramento County already exceed LOS. Should the scenario in the above paragraph play out, this will cause extreme hardship and place a severe financial burden on Sacramento County.

MITIGATION: A study should be made which identifies the cost for fixing each of the 83 roadways in each County and delineate each County's financial obligations, so there will be a clear accounting of the total financial obligation of each roadway project per County as well as identify the approximate fiduciary responsibility to the BDCP for these roadway improvements.

Supporting Information:

- Narrow levee roads – no room to pull over. References to Transportation Management Plans to address narrow levee roads are listed on **pages 19-173 to 19-175** in the event of emergency vehicles on the roadway. However no mention is made of how to address accommodations for transportation of agricultural equipment and school busses that need to pick up children at their homes. Roadways are often used by agricultural trucks and haulers, including tractors of various sizes, to get from field to field, to transport crops and produce, as well as to move spraying equipment. School busses in the areas of construction in the Primary Zone historically pick up and drop off children at their homes on school days.
- Plan should identify how many construction trucks will be added to roads on a daily basis.
- Local agriculture equipment can't compete with large construction vehicles.
- Increased traffic volumes, particularly with wide trucks on narrow levee roads, increase the risk of care accidents and fatalities.
- Mitigation needs to be identified regarding school bus stops and safety of children.

Assessment/Mitigation Measure(s):

- **Plan should provide greater specificity of impact**
- Plan should identify how many construction trucks will be added to roads on a daily basis.
- Adverse/Significant and Unavoidable

BDCP 1754

From: organickim 333 <organickim333@gmail.com>
Sent: Tuesday, July 29, 2014 11:59 PM
To: BDCP.comments
Subject: BDCP Comments
Attachments: Trans-1 Comments , 7-13-14, Vers. 2.doc; Trans-2 Comments , 7-16-14.doc; Trans-3 Comments , 7-16-14.doc

BDCP 1754

From: organickim 333 <organickim333@gmail.com>
Sent: Tuesday, July 29, 2014 11:48 PM
To: BDCP.comments@noaa.gov
Subject: BDCP Comments
Attachments: ECON-1, Alt[1]. 4, Comment 2 7-28-14, KG.docx; ECON-1, Alt[1]. 4, Comment 2 7-28-14.docx; ECON-1, Alt[1]. 4, Comment 3 7-28-14, KG.docx; ECON-1, Alt[1]. 4, Comment 3 7-28-14.docx; ECON-1, Alt[1]. 4, Comment 4 7-28-14, KG.docx; ECON-1, Alt[1]. 4, Comment 4 7-28-14.docx; ECON-1, Alt[1]. 9, Comment 1 7-29-14, KG.docx; ECON-1, Alt[1]. 9, Comment 1 7-29-14.docx

BDCP 1754

From: organickim 333 <organickim333@gmail.com>
Sent: Tuesday, July 29, 2014 11:53 PM
To: BDCP.comments
Subject: BDCP Comments
Attachments: REC-2, Com. 1, Alt. 4, 7-28-14.doc; REC-2, Com. 2, Alt. 4, 7-28-14.doc; REC-2, Com. 3, Alt. 4, 7-28-14.doc; REC-2, Com. 4, Alt. 4, 7-28-14.doc; REC-2, Com. 5, Alt. 4, 7-29-14, KG.doc; REC-2, Com. 6, Alt. 4, 7-28-14.doc; REC-3, 7-25-14.doc; REC-3,Com.2, 7-25-14.doc

BDCP 1754

From: organickim 333 <organickim333@gmail.com>
Sent: Wednesday, July 30, 2014 12:03 AM
To: BDCP.comments
Subject: BDCP Comments
Attachments: REC-1, 7-26-14.doc; REC-2, Com. 1, Alt. 4, 7-28-14.doc; REC-2, Com. 2, Alt. 4, 7-28-14.doc; REC-2, Com. 3, Alt. 4, 7-28-14.doc; REC-2, Com. 4, Alt. 4, 7-28-14.doc; REC-2, Com. 5, Alt. 4, 7-29-14.doc; REC-2, Com. 6, Alt. 4, 7-28-14.doc; REC-3, 7-25-14.doc; REC-3,Com.2, 7-25-14.doc