Think Tank Award Webinar

Climate change impacts on terrestrial biodiversity and ecosystems

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Climate change impacts on terrestrial biodiversity and ecosystems – results based on IPCC and IPBES assessments

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INTERGOVERNMENTAL PANEL ON climate change

CLIMATE CHANGE 2014:

IMPACTS, ADAPTATION, AND VULNERABILITY

IPCC references

IPCC, 2014: Summary for policymakers. In*: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Field CB, et al. (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1-32.

Settele J, Scholes R, Betts R, Bunn S, Leadley P, Nepstad D, Overpeck JT, Taboada MA (2014). Terrestrial and Inland Water Systems. In: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Field CB, et al. (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 271-359.

IPBES

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services

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IPBES references

IPBES (2016): Summary for policymakers of the assessment report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services on pollinators, pollination and food production. S.G. Potts, V. L. Imperatriz-Fonseca, H. T. Ngo, et al. (eds.). Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Bonn, Germany. XLIX (42) pages.

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SPM

Summary for Policymakers

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IPCC, 2014: Summary for policymakers. In: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1-32.

IPCC (2014)

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.

Attribution of observed impacts in the WGII AR5 generally links responses of natural and human systems to observed climate change, regardless of its cause.

IPCC (2014)

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*).

IPCC (2014)

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*).

…..

While only a few recent species extinctions have been attributed as yet to climate change (*high confidence*), natural 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*).

IPCC (2014)

B: FUTURE RISKS AND OPPORTUNITIES FOR ADAPTATION

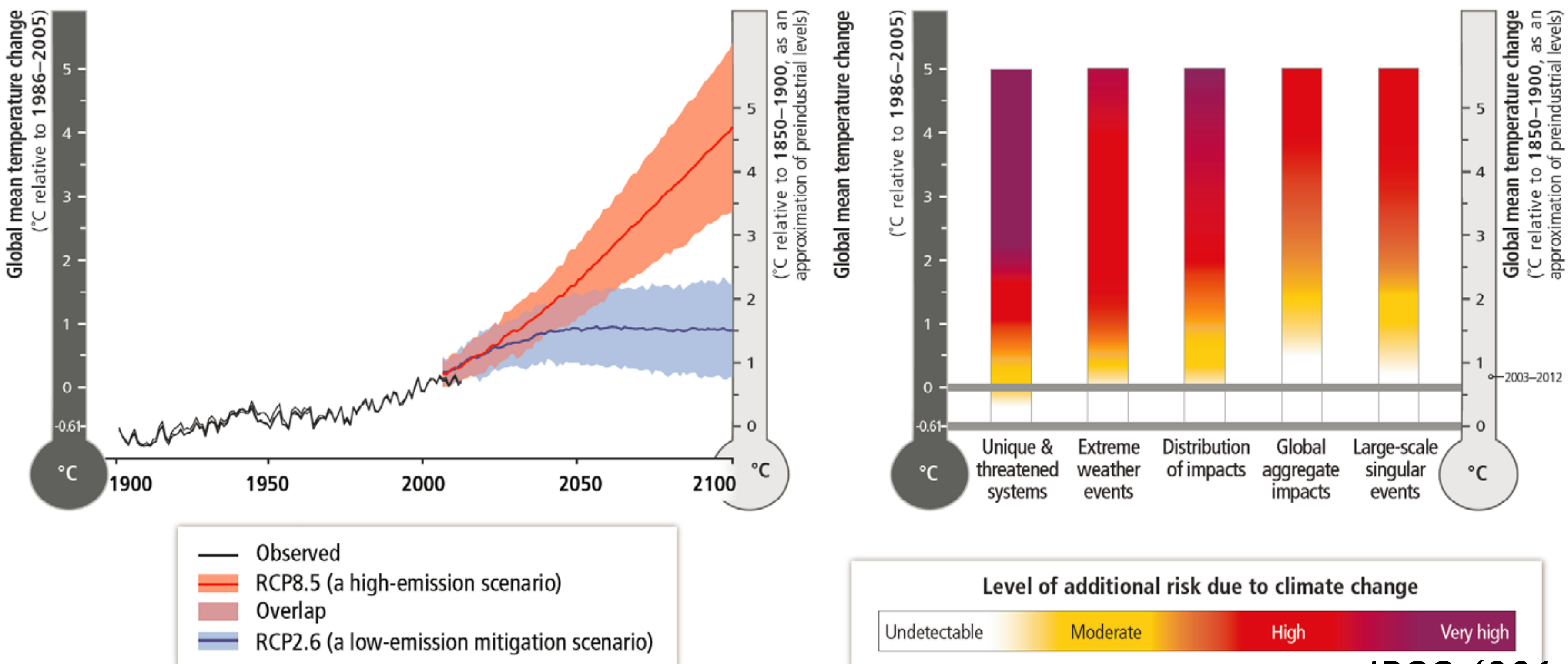
B-1. Key Risks across Sectors and Regions

viii) Risk of loss of terrestrial and inland water ecosystems, biodiversity, and the ecosystem goods, functions, and services they provide for livelihoods. [RFC 1, 3, and 4]

IPCC (2014)

Assessment Box SPM.1. Human Interference with the Climate System
Human influence on the climate system is clear. 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 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.



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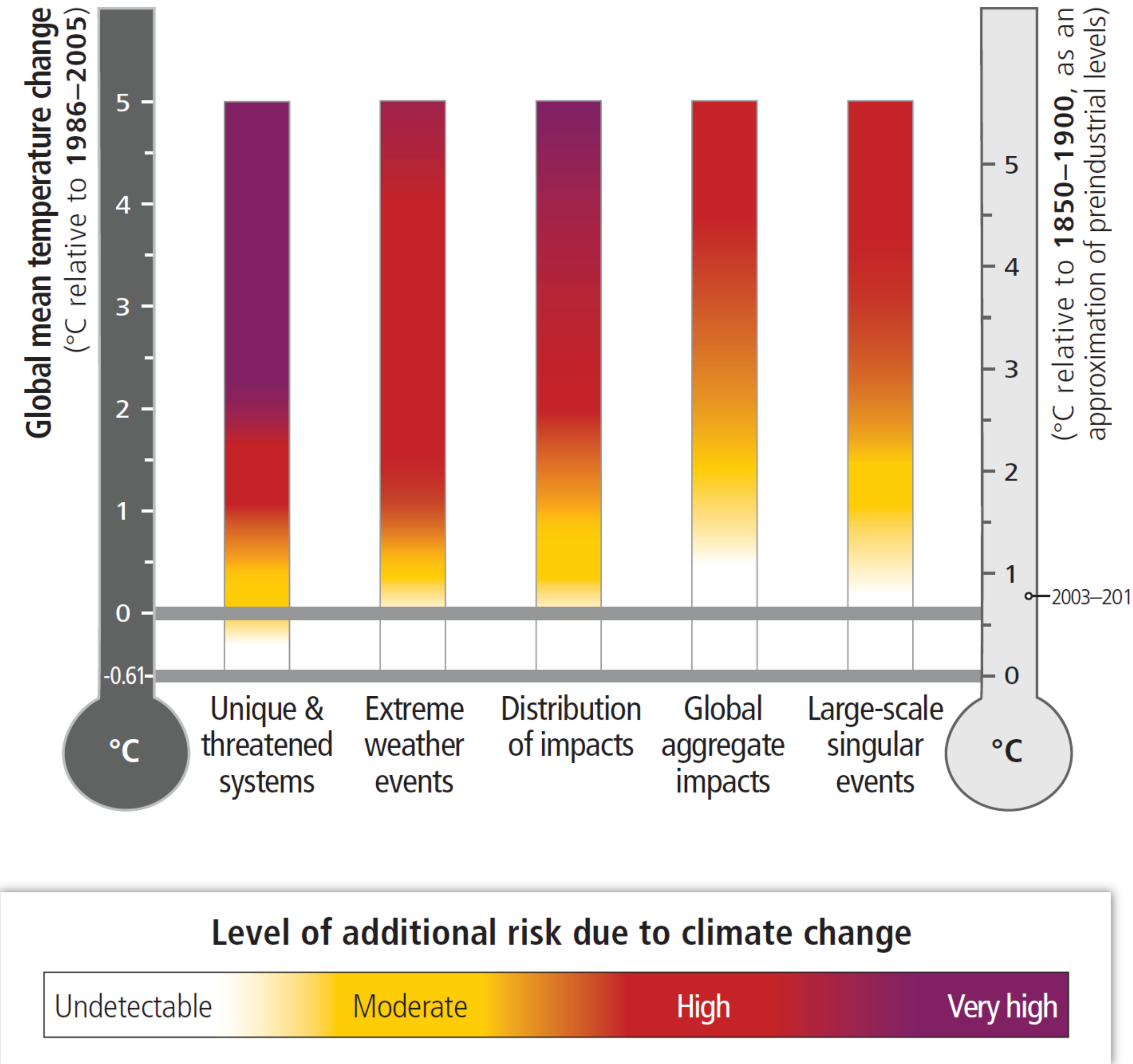
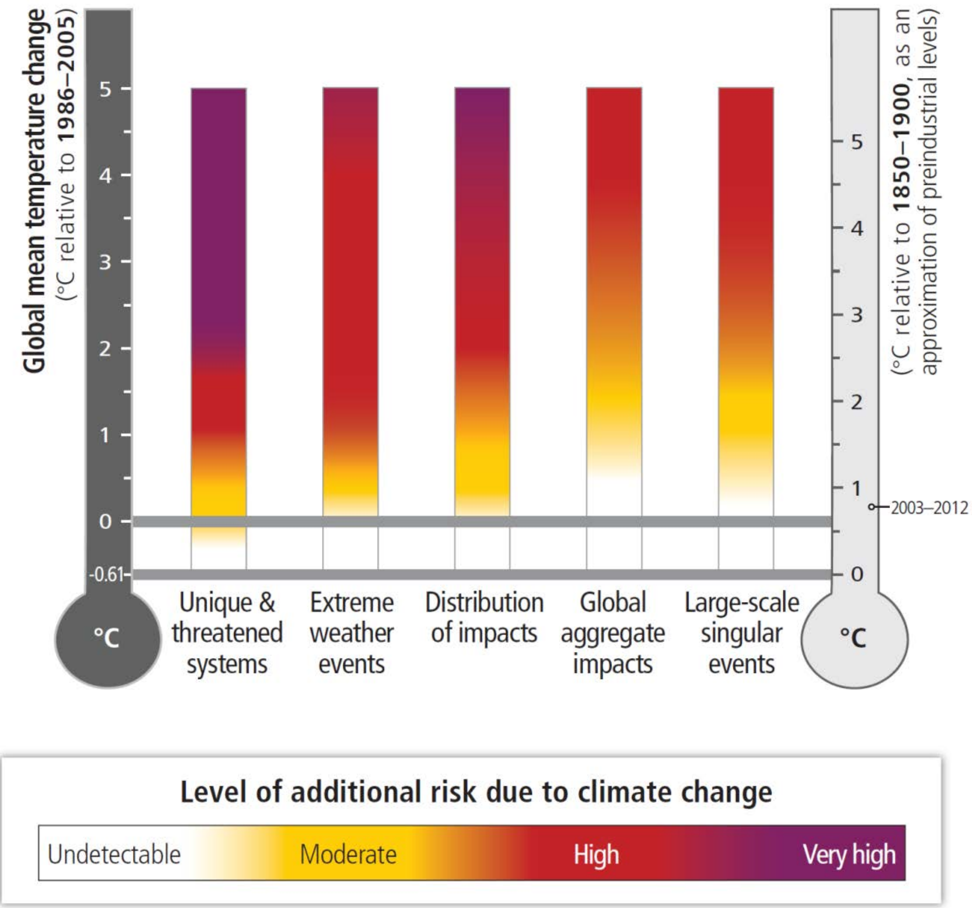


Global mean temperature change
(°C relative to 1986–2005)
5
4
3
2
1
0
-0.61
°C
Unique & threatened systems
Extreme weather events
Distribution of impacts
Global aggregate impacts
Large-scale singular events
(°C relative to 1850–1900, as an approximation of preindustrial levels)
5
4
3
2
1
0
2003–2012
°C
Level of additional risk due to climate change
Undetectable
Moderate
High
Very high

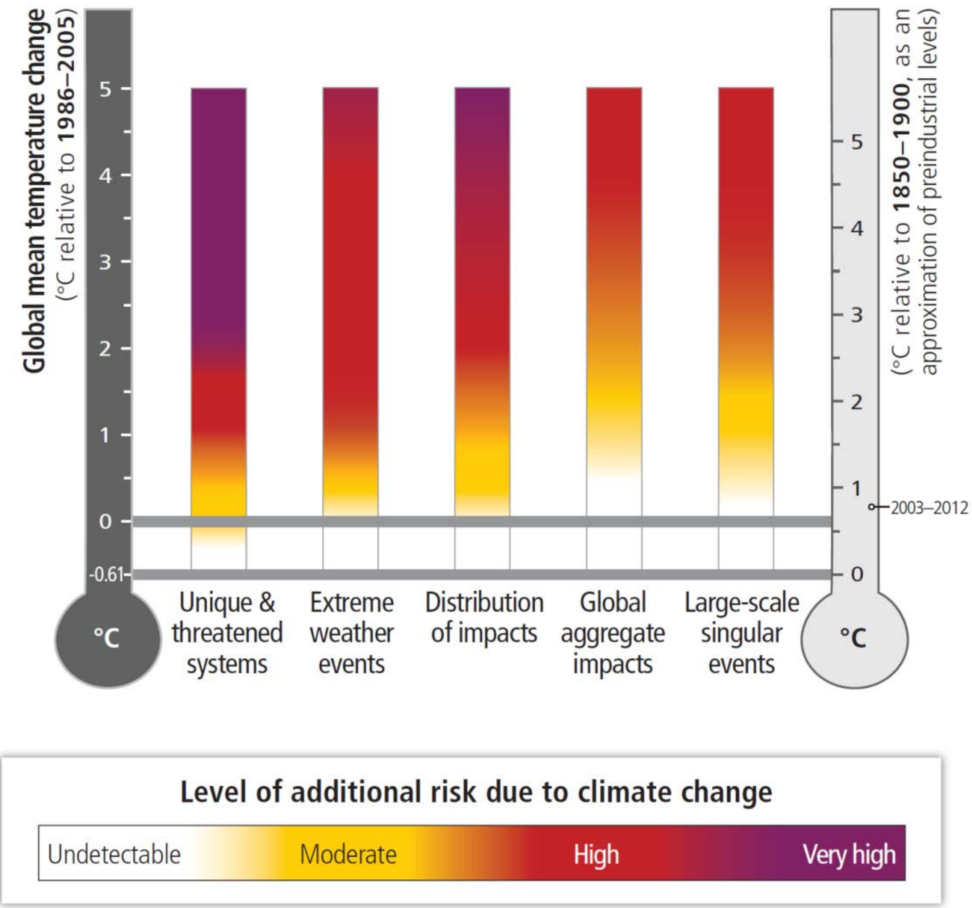


1) Unique and threatened systems:

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*.

IPCC (2014)



4) Global aggregate impacts: Risks of global aggregate impacts …. (to both Earth's biodiversity and the overall global economy). *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.

IPCC (2014)

B-2. Sectoral Risks and Potential for Adaptation

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, overexploitation, pollution, and invasive species (*high confidence*).

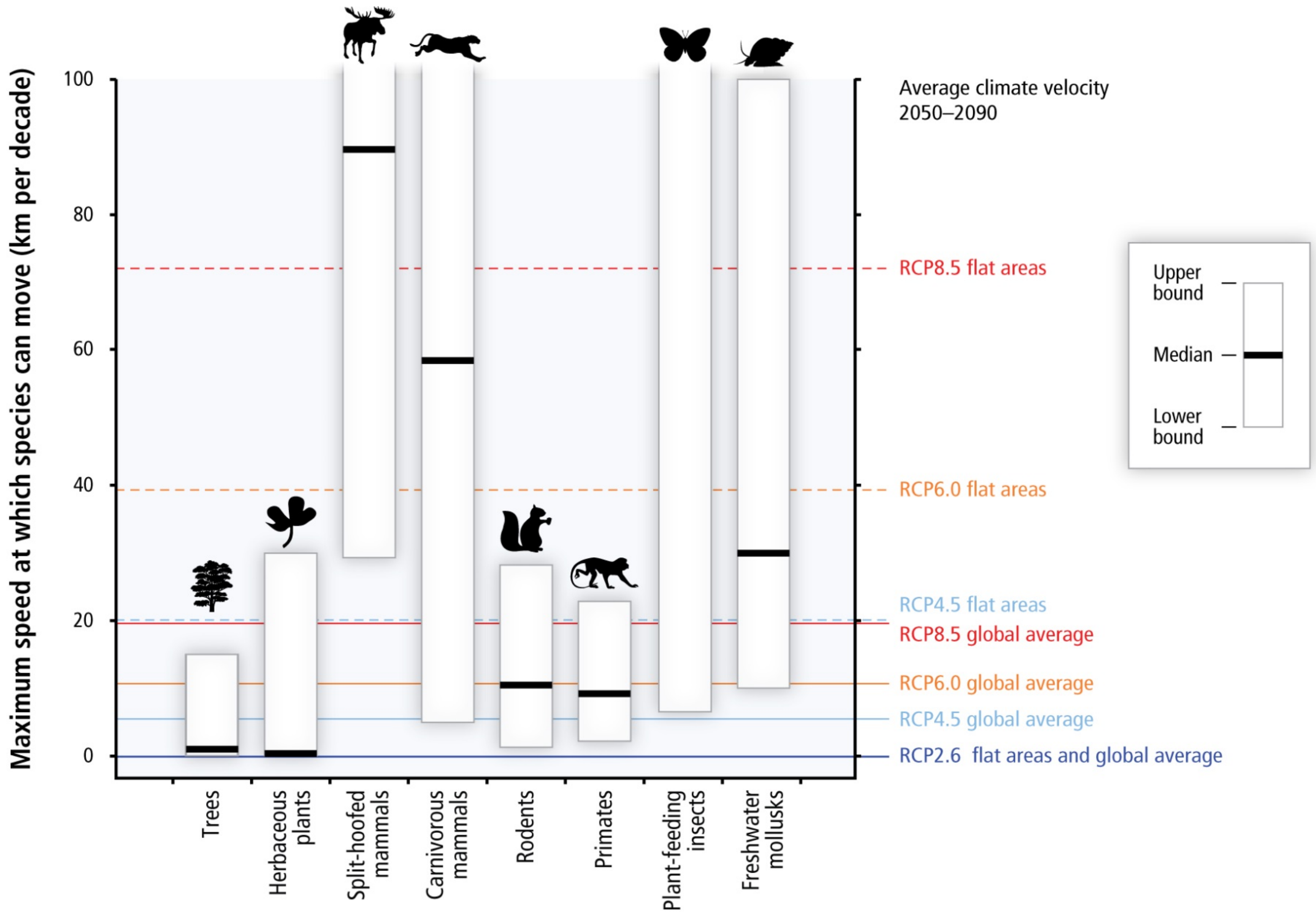
IPCC (2014)

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.

IPCC (2014)

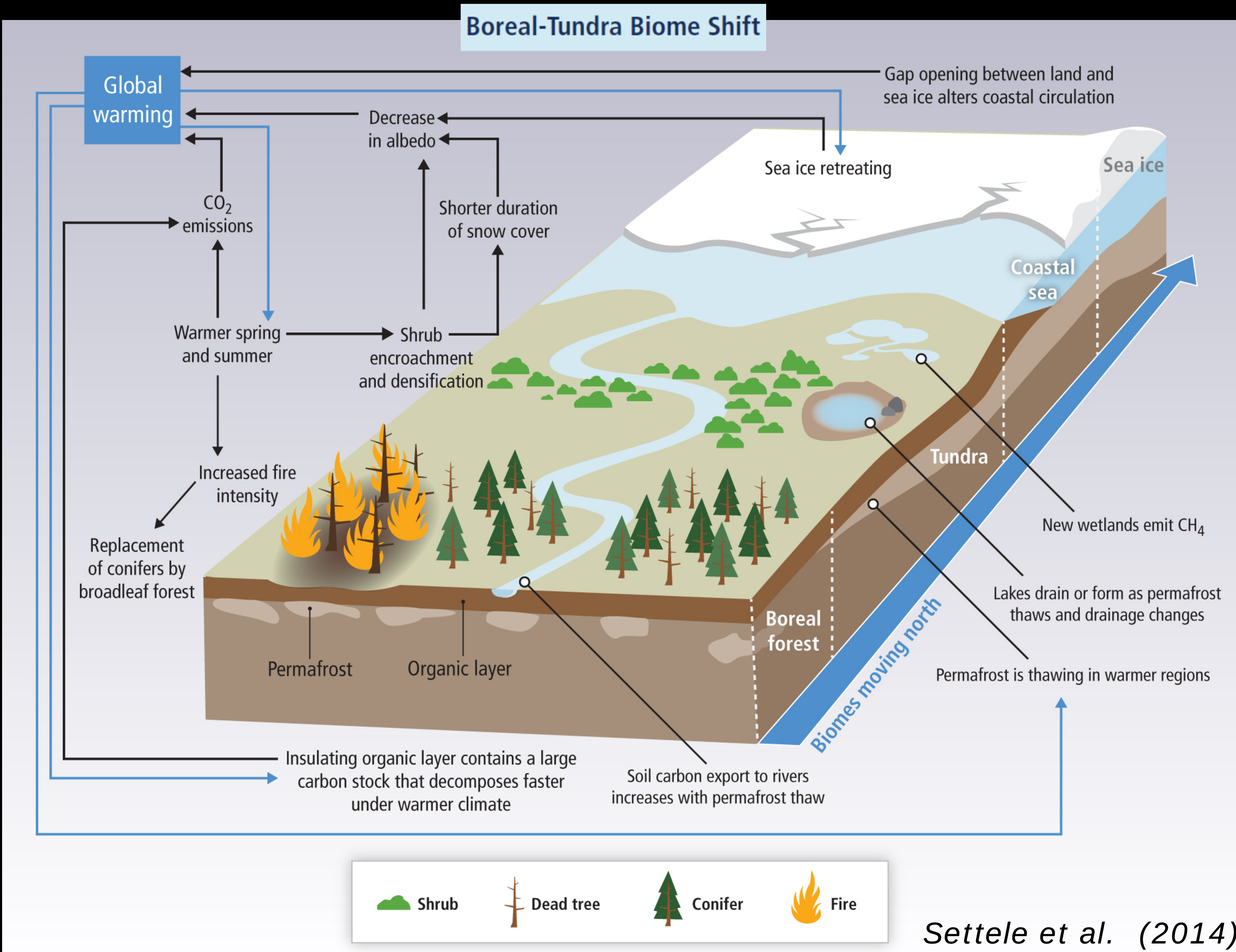

Maximum speed at which species can move (km per decade)
100
80
60
40
20
0
Average climate velocity
2050–2090
RCP8.5 flat areas
RCP6.0 flat areas
RCP4.5 flat areas
RCP8.5 global average
RCP6.0 global average
RCP4.5 global average
RCP2.6 flat areas and global average
Upper bound
Median
Lower bound
Trees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

IPCC (2014)

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*).

IPCC (2014)



Settele et al. (2014)

Boreal tipping point: Arctic ecosystems are vulnerable to abrupt change related to the thawing of permafrost and spread of shrubs in tundra and increase in pests and fires in boreal forests. (medium confidence); and there are hardly any adaptation options in the Arctic.

(from main text of chapter 4)

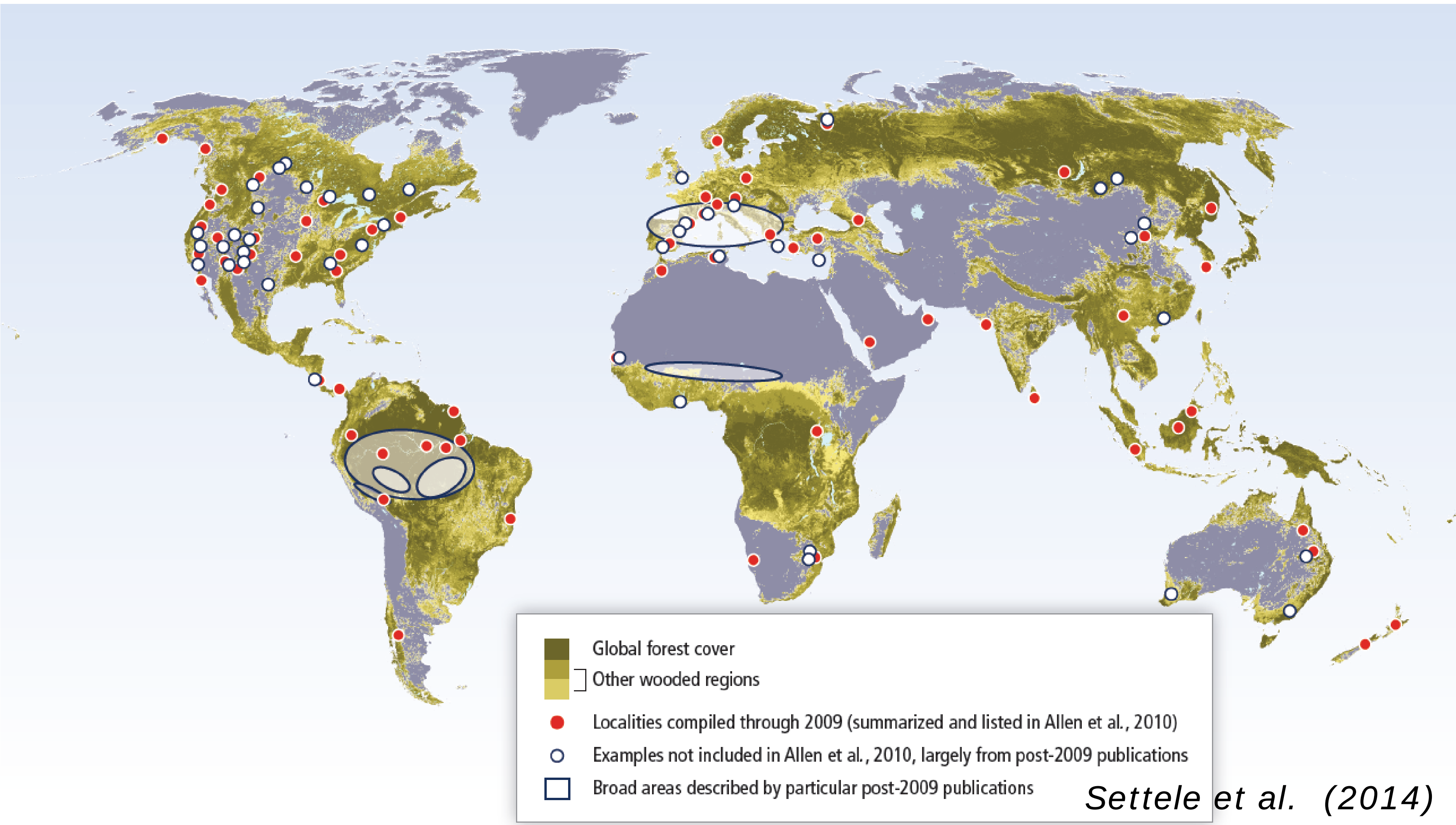
Settele et al. (2014)

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.

IPCC (2014)

Drought- and Heat-Induced Tree Mortality around the Globe



Settele et al. (2014)

4

Terrestrial and Inland Water Systems

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Settele et al. (2014)

EXECUTIVE SUMMARY

Climate change is projected to be a powerful stressor on terrestrial and freshwater ecosystems in the second half of the 21st century, especially under high-warming scenarios such as RCP6.0 and RCP8.5 (*high confidence*).

Direct human impacts such as land use and land use change, pollution, and water resource development will continue to dominate the threats to most freshwater (*high confidence*) and terrestrial (*medium confidence*) ecosystems globally over the next 3 decades. Changing climate exacerbates other impacts on biodiversity (*high confidence*).

Settele et al. (2014)

EXECUTIVE SUMMARY

Ecosystem changes resulting from climate change may not be fully apparent for several decades, owing to long response times in ecological systems (medium confidence).

In high-altitude and high-latitude freshwater and terrestrial ecosystems, climate changes exceeding those projected under RCP2.6 will lead to major changes in species distributions and ecosystem function, especially in the second half of the 21st century (high confidence).

Settele et al. (2014)

EXECUTIVE SUMMARY

A large fraction of terrestrial and freshwater species face increased extinction risk under projected climate change during and beyond the 21st century, especially as climate change interacts with other pressures, such as habitat modification, overexploitation, pollution, and invasive species (*high confidence*).

The extinction risk is increased under all RCP scenarios, and the risk increases with both the magnitude and rate of climate change. ….

EXECUTIVE SUMMARY

(T)here is generally very low confidence that observed species extinctions can be attributed to recent climate change.

Models project that the risk of species extinctions will increase in the future owing to climate change, but there is low agreement concerning the fraction of species at increased risk, the regional and taxonomic focus for such extinctions and the time frame over which extinctions could occur.

Settele et al. (2014)

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Pollinators, Pollination and Food Production

Deliverable 3a

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CHAPTER 2

DRIVERS OF CHANGE OF POLLINATORS, POLLINATION NETWORKS AND POLLINATION

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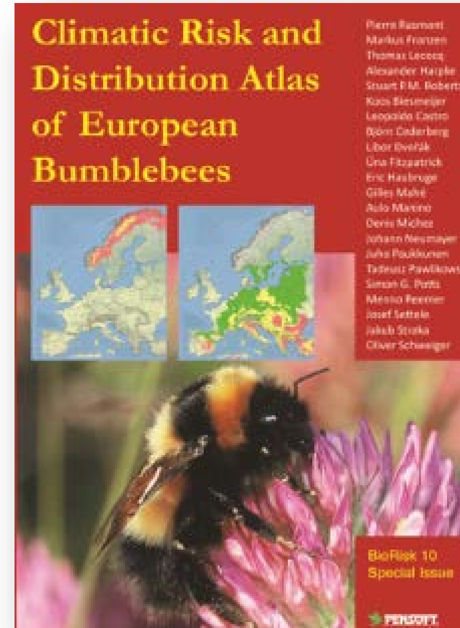
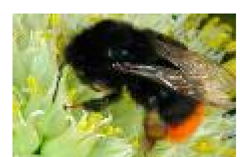
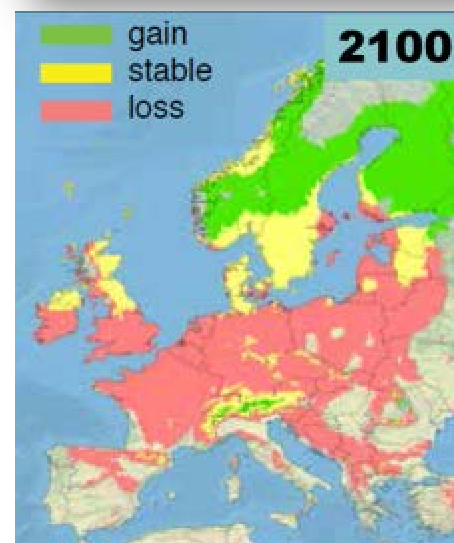
Climate change

Risks

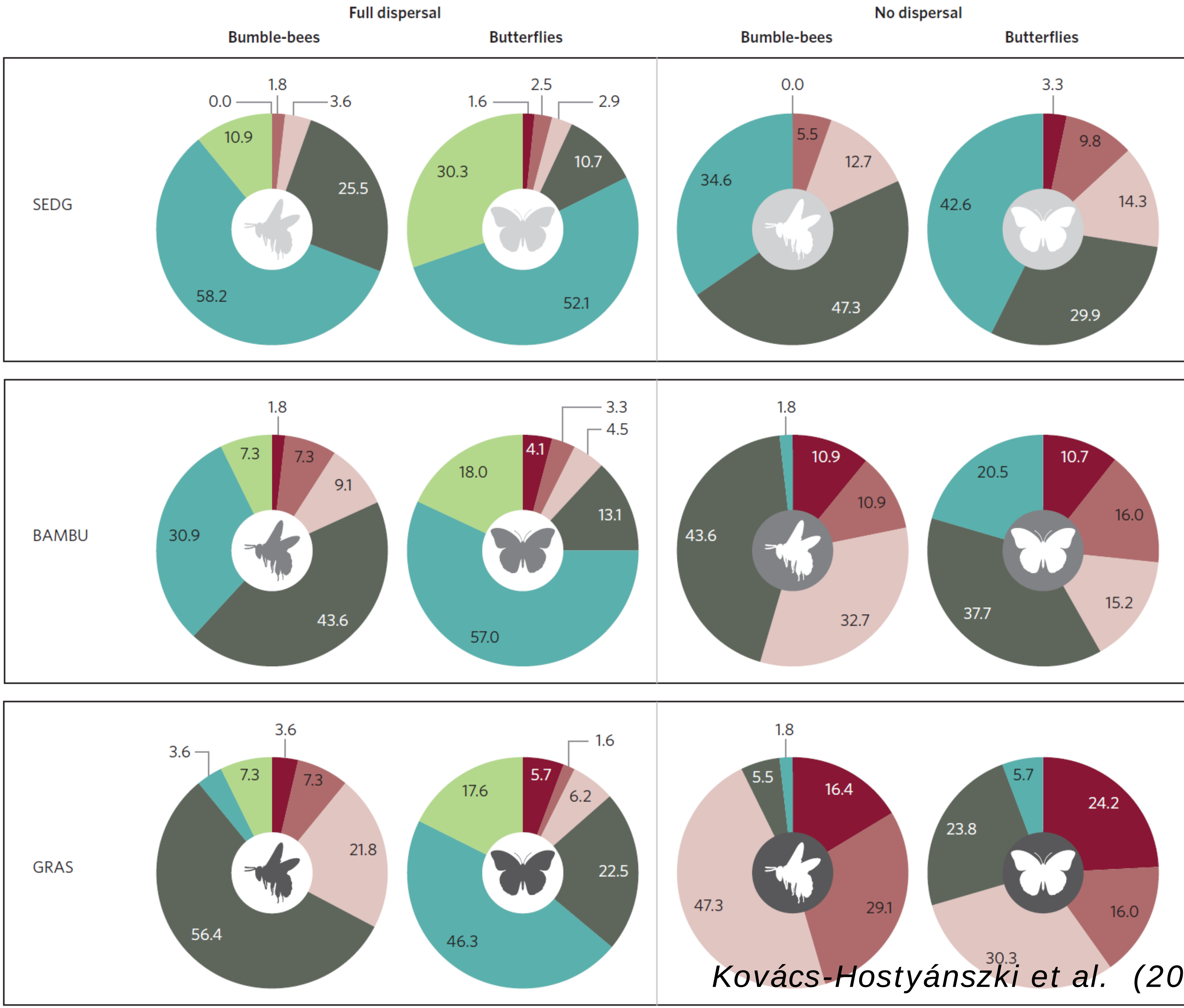
- For some pollinators (e.g. bumblebees and butterflies):
  - **Range changes**
  - **Altered abundance**
  - **Shifts in seasonal activities**
  - **Risk of disruption of future crop pollination**
- Climate shifts across landscapes may exceed species dispersal abilities







Red-tailed bumblebee (*Bombus lapidarius*)



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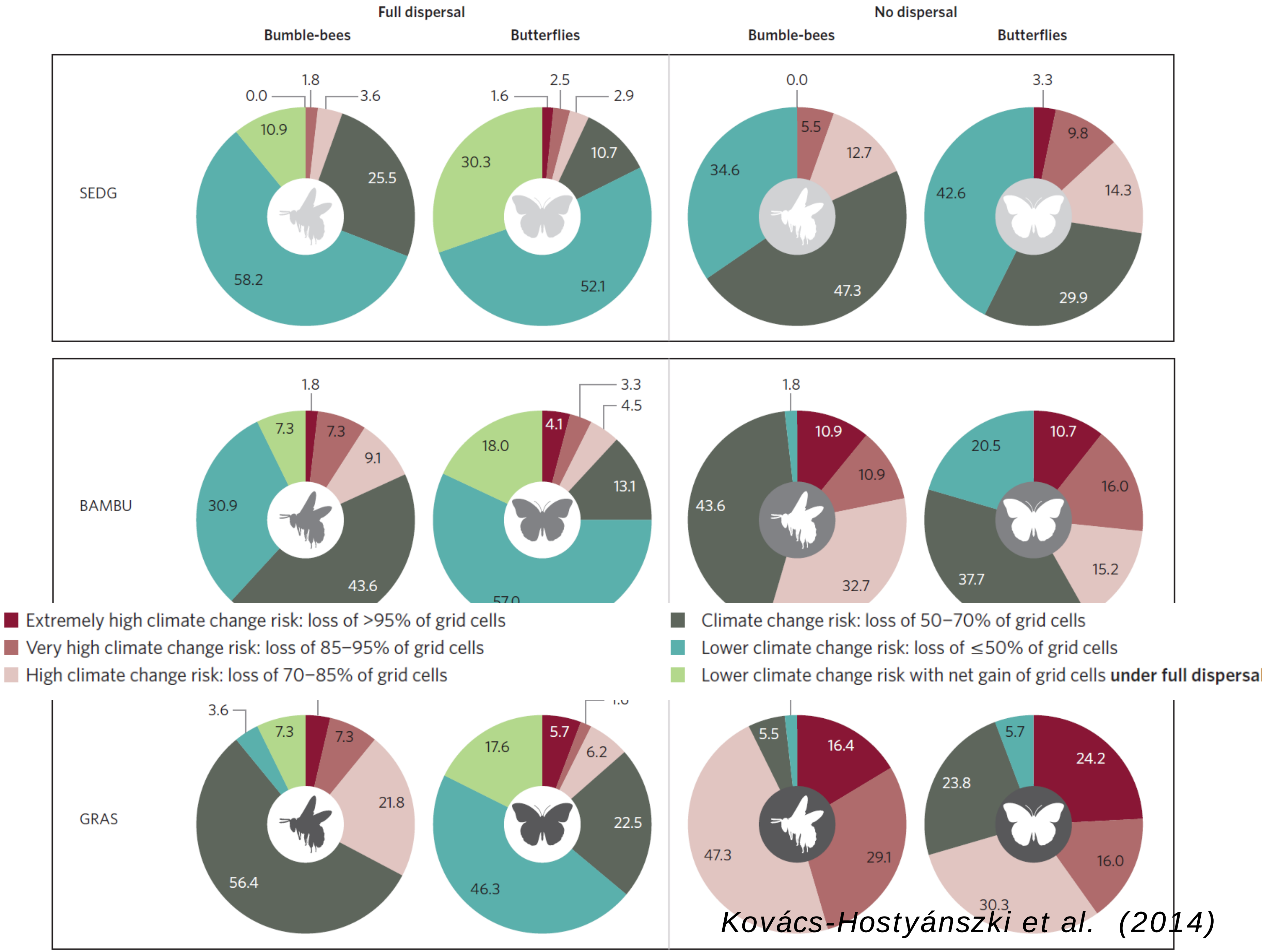

Kovács-Hostyánszki et al. (2014)

EXECUTIVE SUMMARY

Widespread transformation of terrestrial ecosystems in order to mitigate climate change, such as carbon sequestration through planting fast-growing tree species into ecosystems where they did not previously occur, or the conversion of previously uncultivated or non-degraded land to bioenergy plantations, will lead to negative impacts on ecosystems and biodiversity (*high confidence*).

For example, the land use scenario accompanying the mitigation scenario RCP2.6 features a large expansion of biofuel production, displacing natural forest cover.

Settele et al. (2014)


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Q&A

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For time management reasons, we don’t assure that all questions will be answered.

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