

**Preliminary Comments on the Integrated Science Assessment (2nd External Review Draft)
from Dr. James Boyd**

Executive Summary

lxvii, line 11

...dominated by dust and the combustion products of fires...

lxix, line 1

Unclear what “judgments of error” means or refers to. Also, the word “judgement” implies subjectivity, as opposed to an objective assessment of “uncertainty.”

lxix, line 7

Define what is meant by an “endpoint category.”

lxxiv, line 8

Would be useful to provide examples of what is meant by injury. “Injury refers to a range of effects including...”

lxxiv, line 13

Use a more broadly understood term (eradicated, eliminated, extinguished) be used instead of “extirpated.”

lxxiv, line 13

Replace “services to humanity” with “socially valuable ecosystem services.”

lxxv, lines 4 & 6

Define and distinguish, or consolidate use of the terms “species richness,” “biodiversity.” Are they the same thing? If not, explain.

(Comment applies to the use of the terms throughout the document.)

lxxiv, line 27

Add “culturally and commercially important tree species”

lxxvii, lines 26 and 30

Can/should “nutrient ratios” be instead “nutrient concentrations”?

lxxviii, line 15

“...shown to elicit biological responses, such as ...”

lxxix, line 12

What does it mean to “negatively effect competition”?

lxxx, line 12

This should be explained more fully. In particular “chains” and “unique” will not be understandable. Suggested language: “new work identifies a large number of scientifically and economically plausible causal relationships that link ...”

lxxvii, line 16

“...services and their social benefits.”

lxxvii, line 19

Change “over a thousand relationships” to “numerous, but still inadequately quantified relationships...”

Chapter 1.2

Page 6, line 5

Replace “extirpation” with “loss”

Page 6, line 6

“unique species, but also several decades...”

Page 6, line 21

More specific about what “resource collapse” means. Collapse of fish populations, water quality, etc?

Page 6, line 30

“... and services on which humanity...”

Page 7, line 1

“...it is...”

Page 7, line 9

Meaning of “multifunctionality” is unclear.

Chapters 1.11, 1.12, 1.13, 1.14

98, line 6

Confusing. Delete “at different rates”?

110, line 27

Replace “valuation” with “values”

110, line 29 and 111, lines 1-3

Replace sentence that begins “Aside from valuation...

With

“Aside from valuation studies, there is an improved understanding of the numerous causal pathways by which N and S deposition may affect ecosystem services, supported by studies that relate deposition to final ecosystem services under the FEGs-CS classification system.”

111, line 14

Delete “In their work” and insert parenthetical at end of previous sentence.

111, lines 15-17

These references refer to the language above at 111, lines 1-3.

111, lines 25-27

Replace “...and (3) thousands of...” with

“and (3) there is an improved understanding of the numerous causal pathways by which N and S deposition may affect ecosystem services, though most of these causal relationships remain to be quantified.”

Appendix 14

14-1, lines 6-11

Replace the existing text: “The term “ecosystem services” refers to a concept that ecosystems provide benefits to people, directly or indirectly (Costanza et al., 2017), and these benefits are socially and economically valuable goods and services deserving of protection, restoration, and enhancement (Boyd and Banzhaf, 2007). The concept of ecosystem services recognizes that human well-being and survival are not independent of the rest of nature, humans are an integral and interdependent part of the biosphere (Costanza et al., 2017)”

With

“Generically, the term “ecosystem services” refers to the concept that ecosystems provide benefits to people, directly or indirectly (Costanza et al., 2017) and that ecosystems produce socially valuable goods and services deserving of protection, restoration, and enhancement (Boyd and Banzhaf, 2007).”

14-1, lines 13-15

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Replace the sentence that begins “However...” with “However, because ecosystem services are often public goods their benefits can be difficult to monetize. We emphasize that that practical difficulty in no way implies that ecosystem service benefits are small.”

14-1, lines 17-18

“Explicitly linking ecosystem services to social and economic welfare measures has proven difficult.”

14-2, lines 1-3

Replace “thousands of causal relationships...”

with

“new work identifies a large number of scientifically and economically plausible causal relationships that link N and S air pollution to changes in Final ...”

14-2, line 12

Replace “develop” with “quantify”

14-5, lines 5-9

Replace “A few years later, Chestnut and Mills (2005) compared the actual benefits of reducing emissions of NOX and SOX in Title IV of the Clean Air Act Amendments (CAAA) by the estimate of benefits made in 1990. They conclude that quantitative assessment was problematic at that time due to a lack of..”

With

“A few years later, Chestnut and Mills (2005) derived new estimates and compared them to the 1990 estimates of the benefits of reducing emissions of NOX and SOX in Title IV of the Clean Air Act Amendments (CAAA). They conclude that the 1990 quantitative assessment was limited by a lack of...”

14-6, line 1

“...dose-response relationships”

14-6, line 22

Replace “valuation” with “values”

14-6, line 27

“...dose-response relationships between depositions, ecological effects, and services is...”

14-6, line 28

Replace “in developing specific data on” with “to quantification of”

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14-9, line 6

Replace “In other words” with “According to the study”

14-9, line 12

Add “via air deposition...”

14-9, line 13

“alters services. They did this by...”

14-9, line 16

“...then applied per-unit...”

14-18, line 5

Replace “purchase of” with “greater reliance on...”

And replace “leading to” with “associated with”

14-9, line 14

Replace “success” with “spread”

14-22 line 28

Replace “valuation” with “values”

14-22 lines 30-31

Replace the sentence “Aside from valuation, ...” with “Aside from valuation efforts, studies using the FEGS CS have improved understanding of the numerous causal pathways by which N and S deposition may affect ecosystem services.”

Also note that the original language was duplicated on 14-23 lines 10-12. Recommend taking the citations from 14-23 lines 10-12 and moving them up to this spot.

Also delete the sentence at 14-23 lines 13-15 that begins “In these analyses...”

14-23, line 9

Delete “In their work” and insert parenthetical at end of previous sentence.

14-23 lines 29-31

Replace “...and (3) thousands of...” with

“and (3) there is an improved understanding of the numerous causal pathways by which N and S deposition may affect ecosystem services, though most of these causal relationships remain to be quantified.”