Carbon fluxes associated with hydroelectric generation in the Porce region of Colombia

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Introduction

Medellín, Colombia
Medellín, Colombia

Annual increase of 3.3% ~ 50,000 people/yr
Introduction

Energy sources in Colombia

- Hydroenergy: 76.9%
- Natural gas: 14.5%
- Coal burning: 5.7%
- Others: 2.9%
Medellín and the Porce region of Colombia
Impacts of dams on ecosystems according to the World Commission on Dams (2000)

- Terrestrial ecosystems and biodiversity
- Greenhouse gas emissions (CO₂, CH₄, N₂O)
- Aquatic ecosystems, biodiversity and fisheries
- Downstream floodplains
Location of the Porce region, Colombia
Emission scenarios associated with vegetation management pre-flooding

Logging and removing

Burning

Flooding

$\text{CO}_2$

$\text{CO}_2$ and $1.2\% \text{CH}_4$

$\text{CO}_2$

$\text{CH}_4$
Mitigation

Would restoration of surrounding areas mitigate the impacts of the reservoir in terms of GHG emissions?

How much area would be needed?
Results

Carbon stocks in vegetation

![Box plot showing total carbon stocks in vegetation, comparing primary and secondary systems.](image-url)
Results

Emissions from flooded vegetation

![Graph showing GHG emissions from flooded vegetation over time.](image-url)
Results

Emissions from flooded soil

GHG emissions (Mg C ha⁻¹)

Time (years)

- CH4 bubbles
- CO2 bubbles
- CH4 diffusion
- CO2 diffusion
Total emissions due to flooding in CO$_2$e

GWP$_{\text{CH}_4}$ = 23
Results

Cumulative emissions due to flooding in CO$_2$e

![Graph showing cumulative emissions](image-url)
Cumulative emissions due to flooding, logging, or burning in soils and vegetation

- Flooding
- Logging
- Burning
Results

Cumulative emissions due to flooding, logging, or burning in vegetation

![Graph showing cumulative emissions over time for flooding, logging, and burning.]
Carbon accumulation due to restoration

STANDCARB model
Sequestration versus emissions at different management scenarios at a hectare basis
Additional area required for mitigation in a 100 year horizon

- Flooding: 870 ha
- Logging: 834 ha
- Burning: 808 ha
Conclusions

• Vegetation management can influence the amount of GHG to be emitted in hydroelectric reservoirs

• Our modeling exercise showed that burning of vegetation is the management practice with lower GHG emissions for the studied site

• Logging of vegetation pre-flooding can reduce the amount of GHG emissions but this reduction might not be large enough to compensate extraction costs

• Carbon management vs. environmental management
Conclusions

Methods

Results

Introduction

Conclusions

Fauna

Rescue

Fire vs. Flooding
Acknowledgements

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