Drivers of biodiversity loss in the context of Remote Sensing

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Essential Biodiversity Variables

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- Remote Sensing and Essential Biodiversity Variables.
- -Group on Earth Observations - Biodiversity Observation Network, (GEO BON) 2008.
  - Link between in-situ and Remote Sensing information.

- -Global Observation of Forest Cover and Land Dynamics (GOFC GOLD).

Examples of the approach of RS to EVB

- Vegetation phenology
- Net Primary Productivity
- Ecosystem extent and fragmentation
- Habitat structure
- Disturbance regime
- Species distribution

Definitions are important

- A specific definition of biodiversity must be chosen so that proper indicators can be developed to assess efficiently the impact of the driver(s) or disturbance(s) occurring in the region of interest.

- A clear definition of reference scenario or "baseline" is required in order to monitor biodiversity.

- Biome, ecoregion, ecosystem, habitat, land cover, species… watershed.

- Direct, indirect measurements.

Drivers classification

- Drivers are classified as proximate (direct) and underlying (indirect) (Geist and Lambin 2002; Kissinger et al. 2012).

- Drivers are induced factors, natural or human, that directly or indirectly cause a change (Millenium-Ecosystem-Assessment 2003).

- Drivers and Disturbance regimes are closely related.

Drivers of biodiversity loss: direct

- Agriculture expansion has the strongest impact on tropical forests biodiversity (Newbold et al. 2014).

- Agricultural and forestry activities are highly dependent on exotic species, which are considered as an important threat to abundance of native plant species and biodiversity in general (Jauni and Ramula 2015).

Drivers of biodiveristy loss: direct

- It is estimated that approximately 25 million kilometers of legal and illegal roads will be built by mid-century (Laurance et al. 2016).

- Infrastructure of developing projects are important proximate drivers.

- Mining.

- The occurrence, intensity and size of fires are expected to increase in the context of higher temperatures due to climate change (Anderson et al. 2011; Aragão et al. 2007; Le Page et al. 2008; Morton et al. 2013; Oliveras et al. 2014).

Drivers of biodiversity loss: indirect

- Trends of markets and geopolitics (Killeen 2007).
- Technological change (driving to agricultural expansion) (Kissinger, et al., 2012) .
- Aspects of ethics like the failure to account for the importance of biodiversity loss (Hooper et al. 2012).
- Social-political factors are also of great concern, including lack of environmental protection policy enforcement by authorities, uncertain property rights, poverty and all the aspects of human well-being (Crane 2006).

Drivers of biodiversity loss: indirect

- The IPAT equation has been used to understand the driving forces of environmental impacts (I) as a function of population (P), average consumption (A) and technology (T) (York et al. 2003).

- RS studies have demonstrated the usefulness of night time optical data to determine areas of conflict between humans and wildlife (Escobar et al. 2015).

- Urbanized areas are important indicators of human population and their interaction with the environment (Patel et al. 2015).

Drivers of biodiversity loss: indirect

Consequences of climate change such as droughts ([Vogt et al. 2016](#)), extreme precipitation events and major floods.
recurrence ([Cavalcanti 2012](#); [Hoyos et al. 2013](#)) have the potential to become the most important drivers of biodiversity loss ([Strand et al. 2007](#)).

Final comments

- The identification of indirect drivers is important to understand the dynamics of direct drivers across time and space.

- Regional networks are important to bridge the gap between spatial agencies and final users.

- Ground monitoring is required to define the potential of RS data.

- We need to bridge the gap identified by Buchanan et al (2015) between conservation community and remote sensing community, with some conservationists not using the full potential of RS for biodiversity research and monitoring, and some RS specialists not capturing fully the complexity of biological systems.