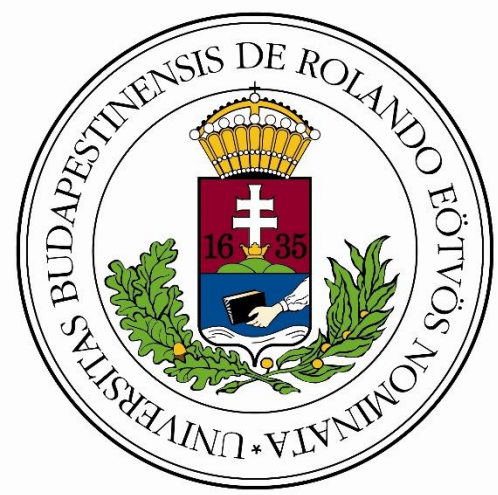


MOBILITY PART OF THE ECOLOGICAL FOOTPRINT IN EDUCATION



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Sustainability is key to the future of mankind. Most of the sustainable development goals, defined by the UN are strongly related to the *ecological footprint*, which measures human demand on nature, expressed as a single, easy-to-understand number that is scalable from an individual to a global level. The use of this simple concept in education is being promoted by an international team of several institutions, by developing digital tools for both online and offline education under an Erasmus+ scheme. The part of *ecological footprint* that is associated with mobility (of both humans and goods) comes mostly from the amount of CO<sub>2</sub> produced by the means of travel (car, plane etc.). This excess CO<sub>2</sub>, which comes from the high-energy lifestyle of today's societies, is the major cause of global warming, which most regard as the most imminent threat to human civilization on Earth.

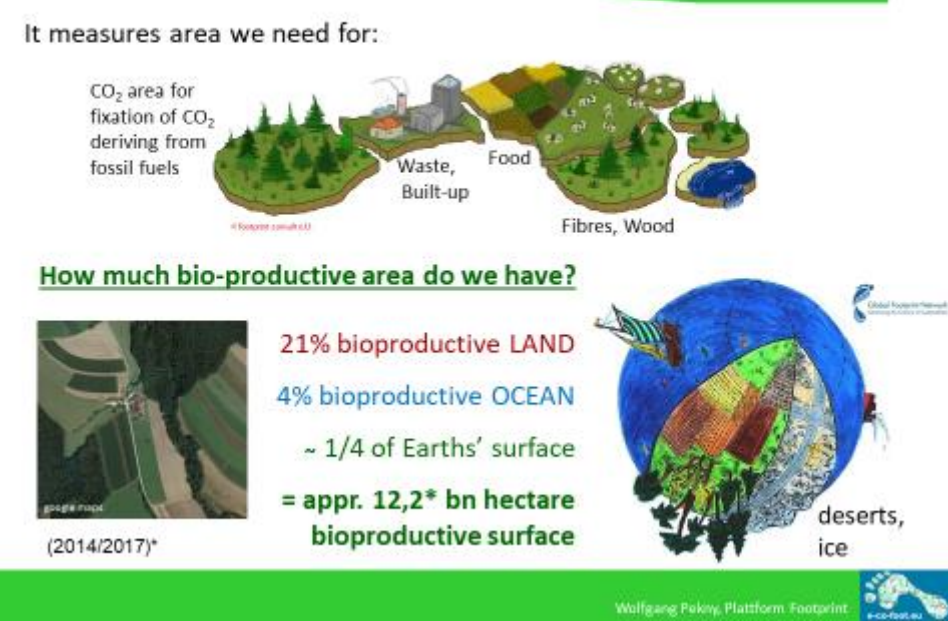
In this poster we show how the mobility part of *ecological footprint* can be calculated, how the size of it can be reduced and how it can be included in the education of teenagers.

*Ecological Footprint*: a measure of the demand populations and activities place on the biosphere in a given year, given the prevailing technology and resource management of that year. [1]

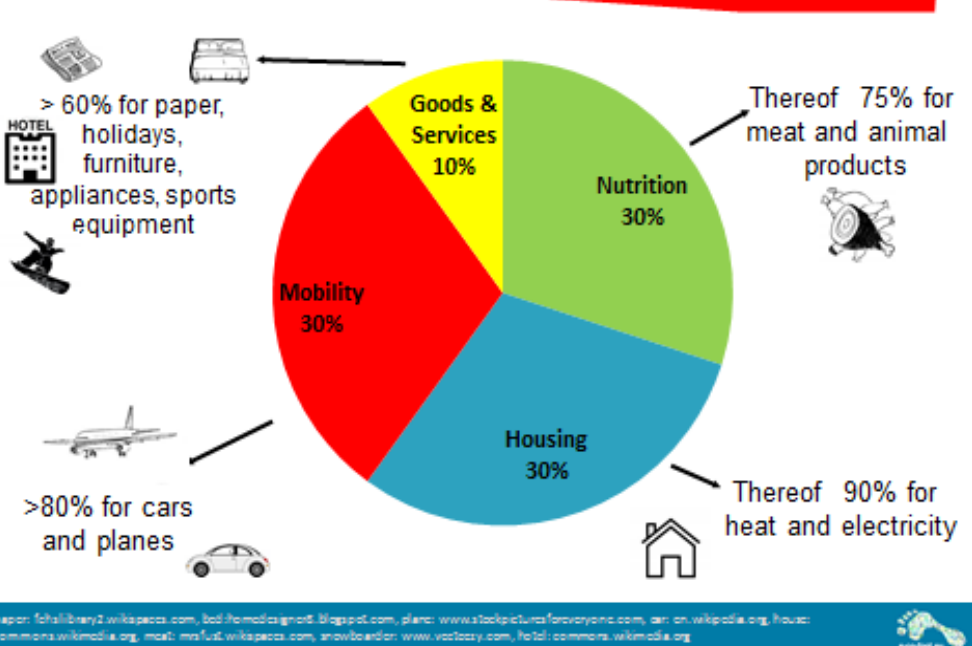
*Biocapacity*: a measure of the amount of biologically productive land and sea area available to provide the ecosystem services that humanity consumes – our ecological budget or nature's regenerative capacity.

Ecological Footprint and biocapacity values are expressed in mutually exclusive units of area necessary to annually provide (or regenerate) such ecosystem services. They include: cropland for the provision of plant-based food and fiber products; grazing land and cropland for animal products; fishing grounds (marine and inland) for fish products; forests for timber and other forest products; uptake land to neutralize waste emissions (currently only the areas for absorbing anthropogenic carbon dioxide emissions are considered); and built-up areas for shelter and other infrastructure. [2]

What does the Ecological Footprint measure?



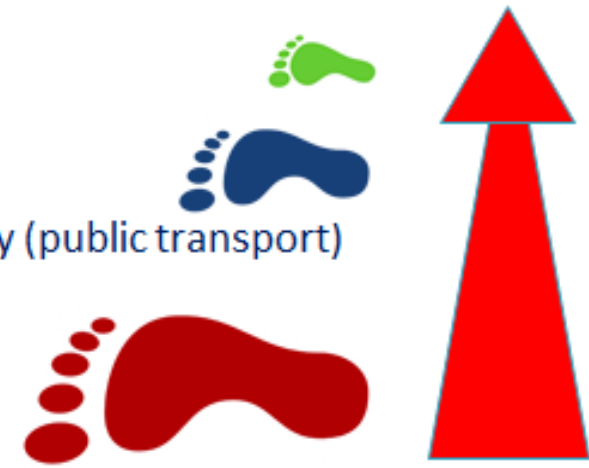
Ecological Footprint of an average Hungarian



The four main categories where our everyday life (on an individual level) impacts the biocapacity of Earth are: Nutrition, Housing, Mobility and Other consumption. 30% of the Footprint of a Hungarian is mobility, that means the moving of people from one place to another. Most of this comes from driving and flying.

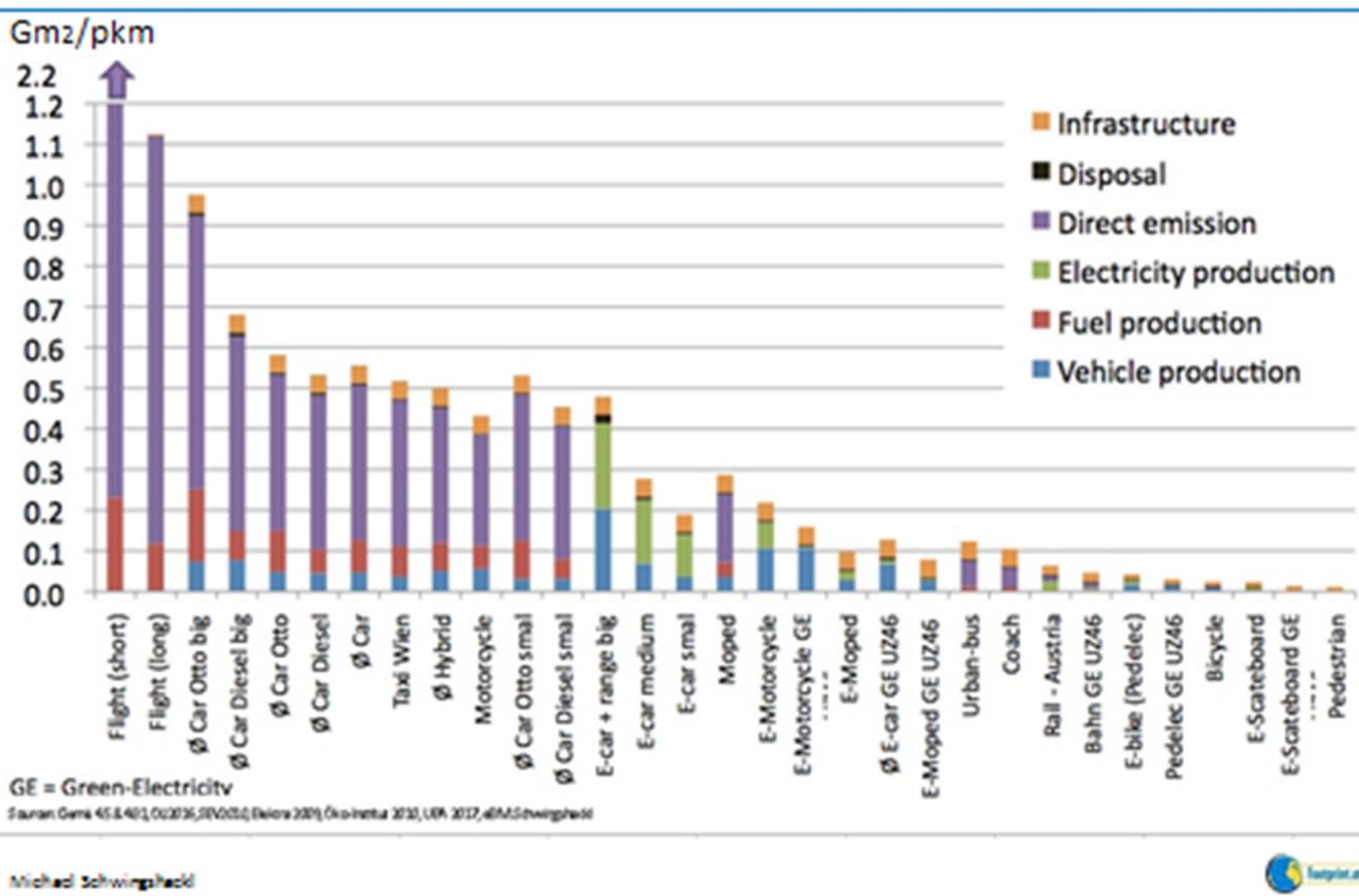
Ecological Footprint of modes of travel

- on foot
- by bike
- by train (boat)
- by bus, tram, subway (public transport)
- by car
- by airplane



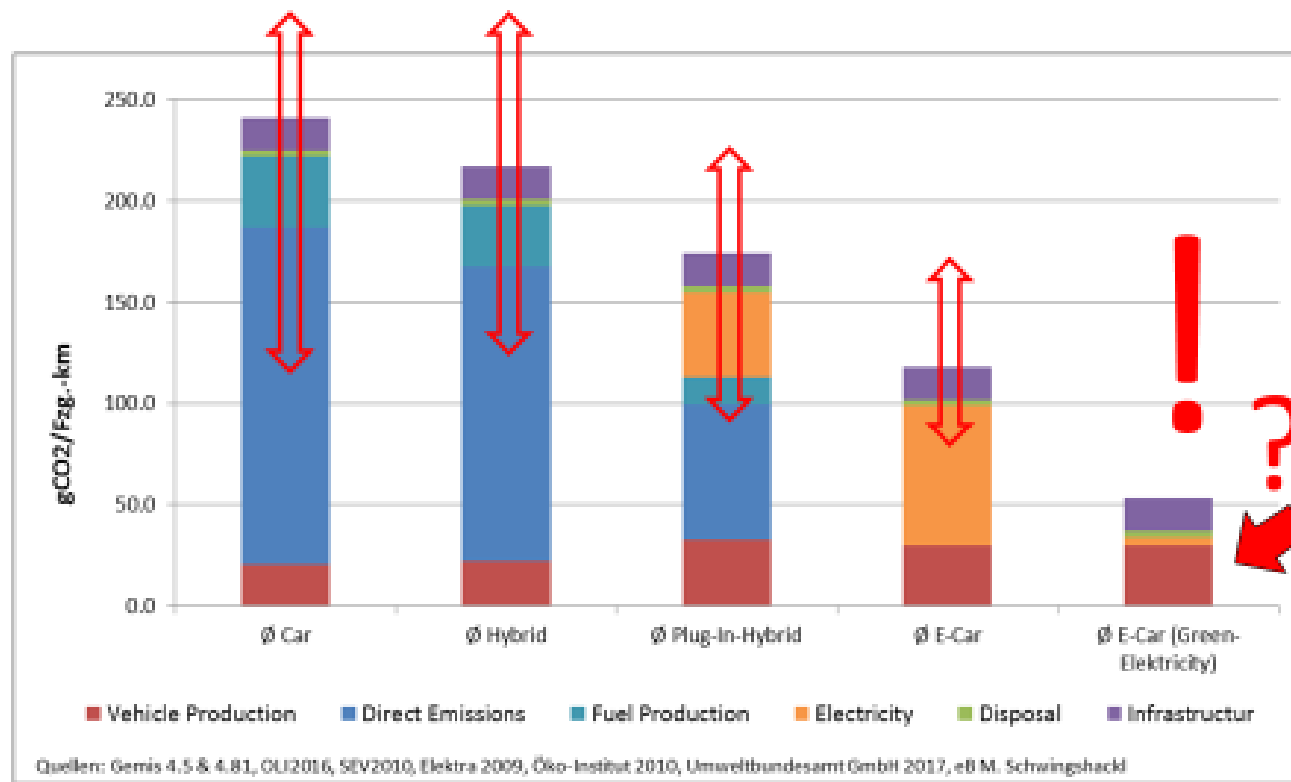
The footprints increase from top to bottom. Human-powered mobility (walking, bike, scooter) have almost no footprint at all and help you stay fit and healthy. Public transport has moderate footprint – many people share them. Cars have a BIG footprint (electric cars not so big). Airplanes have an EXTREMELY BIG footprint, you should avoid them!

Ecological Footprint of passenger transport



In this chart you can see the size of Ecological Footprint associated with each mode of passenger transport. There are many car types and engines listed, and the footprints (in global squaremetre over passenger kilometre) range from almost nothing (pedestrians, bicycles) to more than 2.2 gm<sup>2</sup>/cap (short flights). These values are not only the CO<sub>2</sub> masses directly burned by the engines, they also contain the energy needed to produce and maintain the road or the car itself. The relatively short (less than 1500 km) flights have an extremely high value, because the airplanes consume the most when they are accelerating and climbing. There are 2 other factors that make air travel by far the worst mode of transport, namely you cover a very long distance when you fly, very fast, and that the exhaust gases pollute our atmosphere at a very high altitude where the air is very thin and thus most vulnerable. The CO<sub>2</sub> emissions per passenger km and the Ecological Footprint values vary considerably with the type of the engine, size of the vehicle, the number of passengers carried and the distance covered.

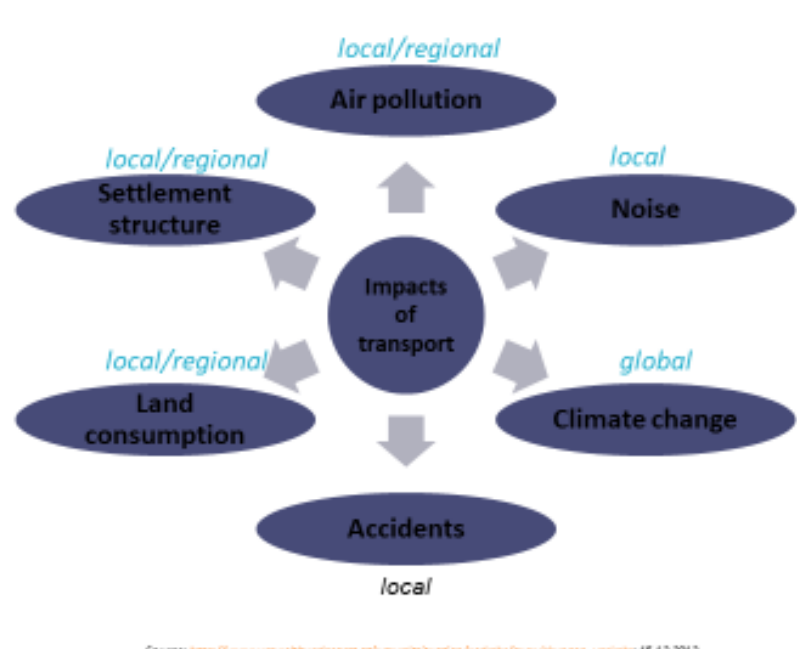
CO<sub>2</sub> Emissions (private car)



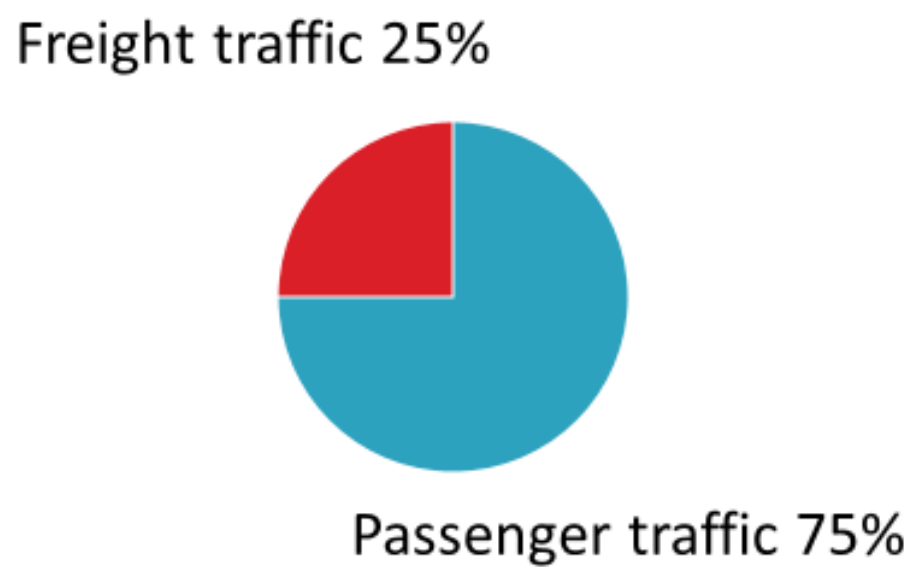
The CO<sub>2</sub> emissions of different engine technologies. Note, that the range (red arrows) is as big, as the difference between the first 3 car technologies containing internal combustion engines. This means that you are better off with an economic compact car than with a big thirsty hybrid, containing two engines. You can also see, that the new electromotor technology can lower your footprint as well, but in order to make a considerable change, you need to use green electricity for charging your batteries!

Average car (with internal combustion engine), average hybrid (also a small battery and small electric motor), plug-in hybrid (bigger battery that can be charged at the grid and therefore more electric driving range), e-car, and e-car using green electricity – UZ46 in Austria for example, or photovoltaic

Environmental impacts of transport and logistics



Transport of goods



Passenger traffic is more than twice as high as freight traffic! There is plenty of room to lower them both!

Holidays (leisure, sports, hobbies)

- You can have a perfect vacation in your own country!
- If you travel abroad, consider the train!
- Try to avoid flying! It has the highest footprint.



In order to have a perfect vacation, you do not have to travel very far: sometimes the next town, wood or lake is enough to leave your problems at home and regenerate yourself and have a nice time with your family. You should keep in mind, that flying is the most environmentally unfriendly travel mode! If it is cheap, it doesn't mean, it is sustainable, or comes at low "ecological costs". It just means that someone else is paying the costs: usually your children/grandchildren or your old parents/grandparents.

How can you decrease your footprint?

Walk or bike to school/work!

- It is cheap!
- It is healthy!
- It is fast! (trips within 1 km are faster on foot, within 2 km by bike)
- You can see more!
- The air is cleaner.
- You help save the planet!

How can you decrease your footprint?

- If you live farther, use the community transport! (train, bus, tram, underground)

Why?

- Smaller footprint.
- Less accidents, safer than car travel.
- You can meet your friends on board.
- You can read, work or learn aboard.
- You can use wi-fi on the bus/train.



How can you decrease your footprint?

- If you cannot avoid car travel you can still lower your footprint if you:
- share your car (never travel alone!)
- optimize your route (no extra miles!)
- use a smaller car
- reduce speed
- use correct tire pressure
- avoid pointless acceleration/deceleration
- consider new technology

Take home messages

- 80% of the Mobility Footprint is caused by cars (70%) and flying (10%) (goods transport is counted towards consumption)
  - Therefore most important is:
  - Use cars less!
  - Travel without using planes!
  - Buy local products at a local store!
- These measures can reduce the Mobility Footprint considerably.

If you want to save the planet for yourselves and your grandchildren, ask how your grandparents used to live and try to adapt those ideas in your life.

5-FINGER RULES – to REDUCE footprint

- E**njoy life with a smaller footprint: more friends, family, time, fun
- A**ct together to create a sustainable world that supports living on a small Footprint!
- R**educe meat and animal products! Prefer local and seasonal products, as much as possible from organic farming
- T**ravel with a small Footprint – with train, bike and bus. Don't fly! Ride cars less, never alone, with green electricity!
- H**ome green home! with green energy, well insulated, smaller, access to public transport



- [1] M. Wackernagel, W.E. Rees: Our Ecological Footprint: Reducing Human Impact on the Earth, New Society Publishers, Gabriola Island, BC (1996)
- [2] M. Borucke et. al.: Accounting for demand and supply of the biosphere's regenerative capacity: The National Footprint Accounts' underlying methodology and framework, Ecological Indicators, 24, 518-533 (2013) <https://doi.org/10.1016/j.ecolind.2012.08.005>