"E-CO-FOOT" - USE OF ECOLOGICAL FOOTPRINT IN EDUCATION

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Abstract: 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 measure 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 main aim of the project is providing children aged 10-18 with sound knowledge about global ecological problems and conscious consumption using innovative methods in several European languages. The first results of this cooperation facilitating ecological education by using new digital skills on modern and widespread devices (smartphones with GPS) as well as the ways it can be integrated into different subjects according to the national curricula are presented in this paper.

Definitions

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 (Wackernagel 1996).
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 (referred to as footprint henceforth) 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 (Borucke 2013).

Short project aims

The aim of the "*e-co-foot*: E-co-logical Footprint Training - digital resources for online and offline education" Erasmus+ 2017-1-AT01-KA201-035037 project is to provide *online and offline learning and teaching material, background material and software and e-learning tools* in 5 European languages in an international collaboration, between akaryon GmbH, a research based Austrian SME specialized in environmental educational informatics,

the Viennese NGO Plattform Footprint, the Savaria Chemistry Department of the Eötvös University in Hungary, the Greek Environmental Education Center Pertouliou-Trikkeon and the Vasile Lovinescu College, a Romanian VET high-school providing courses in ecology and environment.

Mini hectare workshop

One of the teaching methods proposed by Plattform Footprint, is the so-called mini hectare workshop, where each pupil (or group of them) can calculate an estimate of the ecological footprint, which is based on his/her own lifestyle and consumption. They can compare it to a fair share of an average citizen expressed in global hectares per year (gha/yr). This can be easily calculated, by dividing the total biocapacity by the total number of people living on Earth. The four main categories where everyday life impacts the biocapacity of Earth is: *Nutrition*, *Housing*, *Mobility* and *Other consumption*. There are several factors in each category which will have a major impact on the individual footprint.

The *nutrition* part of the footprint mainly depends on the amount and type of food one consumes. Meat and animal products have a disproportionately large footprint compared to vegetables. Also, the amount the food travels has a high impact on its footprint. Consequently, if one has a balanced, healthy nutrition according to the food pyramid, and has a healthy lifestyle with sports and no overweight, and eats local and mainly vegetable-based food, this portion of the individual footprint is not large.

The main component of the *housing* part of the footprint is the energy needed to construct and operate (the latter being usually much larger) the houses/apartments people live in. So the individual footprint is decided by the size and material of one's home, when it was built, what type of heating it has and how energy efficiently it is operated.

The *mobility* part of the footprint is decided by how much a person travels and by what means. The covered distance comes from daily commute to/from work/school, plus business and leisure trips. The most common means of transport can be in the order of increasing footprints: on foot – by bike – by public transport – by car – by airplane.

The *other consumption* part of the footprint is the sum of the footprints of other individually consumed products and/or services. The most common and important types in this category are paper consumption, furniture, sports equipment, clothing, electronics: PC-laptop, mobile phone etc.

The part of the footprint that cannot be attributed to the consumption or action of individuals but to the whole community is usually referred to as *grey footprint*. It is country-specific, like the ecological footprint itself, and contains the footprint of roads, hospitals, schools, courts, police and all public buildings.

Ecological footprint of countries

According to the Global Footprint Network [footprintnetwork.org 2013], the participating countries had the following per capita ecological footprints (in gha/yr): Austria 6.02, Greece 4.12, Hungary 3.27, and Romania 2.71.

The average for the whole world was 2.87, and 4.75 for Europe. The countries having an average over 10 gha/yr were Qatar and Luxemburg. The available biocapacity for that year was 1.69 gha/yr per person.

Based on country-specific statistical data gathered by the participants, the distribution of the footprint into the four aforementioned most important categories of consumption were calculated. There is considerable difference between the different participating countries, but most of these main categories account for roughly 20-30% of the footprint (Schwingshackl 2018).

Inclusion of the course into the school program

An important question related to the course on ecological footprint to be answered is how to teach sustainability in Hungary and the other three European program countries. What is the legal background and regulation regarding education and sustainability?
Hungary has a special situation, because its constitution is relatively new, so sustainability is even written in it. Part of Hungary's current constitution:

...Foundation P) (1): ... Natural resources, in particular arable land, forests and the reserves of water, biodiversity, in particular native plant and animal species, as well as cultural assets shall form the common heritage of the nation; it shall be the obligation of the State and everyone to protect and maintain them, and to preserve them for future generations. ...

Even if not written in the constitution, most European countries have a "National Sustainable Development Strategy" or a similarly called strategy related to some forms of sustainability, and together with the specific law governing education, it is reflected in the corresponding national curricula. These curricula usually contain sustainability at several places, meaning pupils will encounter it in several years and several subject groups, not only in one specific subject in one year.

They can contain non-classical or out-of-class forms of education where sustainability has a special role (thematic days or weeks, special excursions). In Hungary, for example there exists a thematic week on sustainability – usually at the end of March or April, around Earth Day (April 22nd). Another Hungarian example is the common good practice, that classes in primary school go to forest schools: they camp in a forest for a week in May/June, and learn their subjects with a connection to nature, forests, sustainability.

Subjects most fit for the course

In order to make a connection to the body of knowledge and skills being taught in schools according to the national curricula, we need to pick the subjects most fit for this program (through the entire 12 school years). We give in parentheses the number of school year that particular subject is usually taught, between 1 and 12.

The most fit subject for our goal is foreign language(s) (English, German, etc. 3-12), not only because it is being taught for many-many years, and in all countries, but also because in these subjects a neutral topic is usually chosen to practice the vocabulary and grammar.

Pupils are usually more open to a topic when it is not a must-learn, but rather a seemingly side effect. Also, the courses will be developed in English and German, so most European pupils will get access to it because most of the learn one or the other language in school.

Ethics, which is taught parallel to religion (5-12), is a subject where the deep morality of the ecological footprint issue can be discussed. Since it is an ethical issue, it can help understand the individual vs. society paradigm.

Then come the science subjects, which are thematically closest to environment and sustainability. In primary schools it is taught with the title "Our environment" (1-4). After that the different science subjects are either taught combined as "Nature" or "Science", or, especially from the 7th grade on, separately as biology, chemistry, physics or geography. Of all these nature or biology seems to be most fit thematically, but all of them are well connected to the topic.

Teacher training

The teachers who are about to teach our course need materials, and we need to train them how to use those teaching materials.
A guide to starting points for teachers of different school subjects is needed, in two versions at least. One version is needed for the teachers of science subjects, another one to the teachers with less scientific background.
A handbook or manual needs to be compiled of the different global ecological problems and sustainability. It also has to be shown how these global problems are reflected in the ecological footprint calculation.
Background information is needed for each learning unit, with in-depth data for the teacher so that he/she could answer the questions of the pupils.
Different depth of content, methodology and didactics are needed for the two different age groups (10-13 and 14-18 years old).
A special guide is needed for special class environments, or occasions: like excursions, class project lessons, projects on Ecological Footprint, thematic week/day projects etc.
Towards the end of the project a course material needs to be developed for teacher training.

Software tools (calculator)

During the course of this project an ecological footprint calculator will be developed which will have a very user-friendly front-end, and the data will be country-specific as well as the language and the behaviour. It should be well adjustable and flexible enough to be used within and beyond our course for different age groups. It will also serve as data collection application of user behaviour.
Our course will be available in blended learning environments, we shall incorporate e-learning tools and make it available online.

Virtual eco-footprint

One specific method is mentioned here in some detail, which makes it possible to use the modern devices almost every schoolchild carries around all the time in the ecological footprint course.

The virtual eco-footprint project is aimed at the interpretation of the footprint, the calculation of the area used and its in-field presentation. Another objective is to familiarize students with their narrower-wider environment. In addition to global values, show the environmental and cultural values of their own residence.
The modern tools of the 21st century offer the use of the smartphone and the world wide web to provide electronic data collection and database building. We want to create a relationship between teenagers and nature. We adopt mobile applications that are easy to use on the ground and document the environment well.

In short, after calculating one's own footprint using the calculator, one should categorize the types of areas one needs for his/her own subsistance (farmland, pasture, forest for paper/furniture, forest to bind CO_2 released by consumption etc. see Figure 1.), then look for a similar area in his/her own surroundings, walk around it with a smartphone, and upload and sketch the track onto an electronic map (e.g. Google Earth, see Figure 2.).

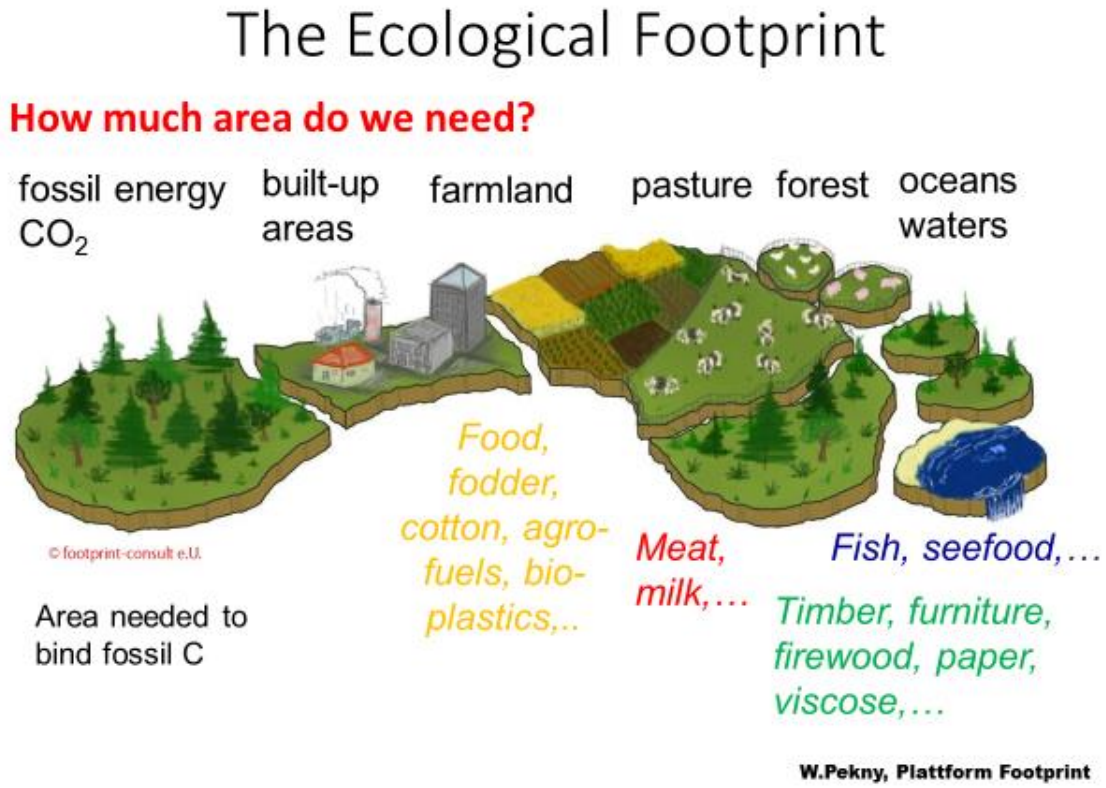

Figure 1. A cartoon of the composition of the ecological footprint, for illustration only.

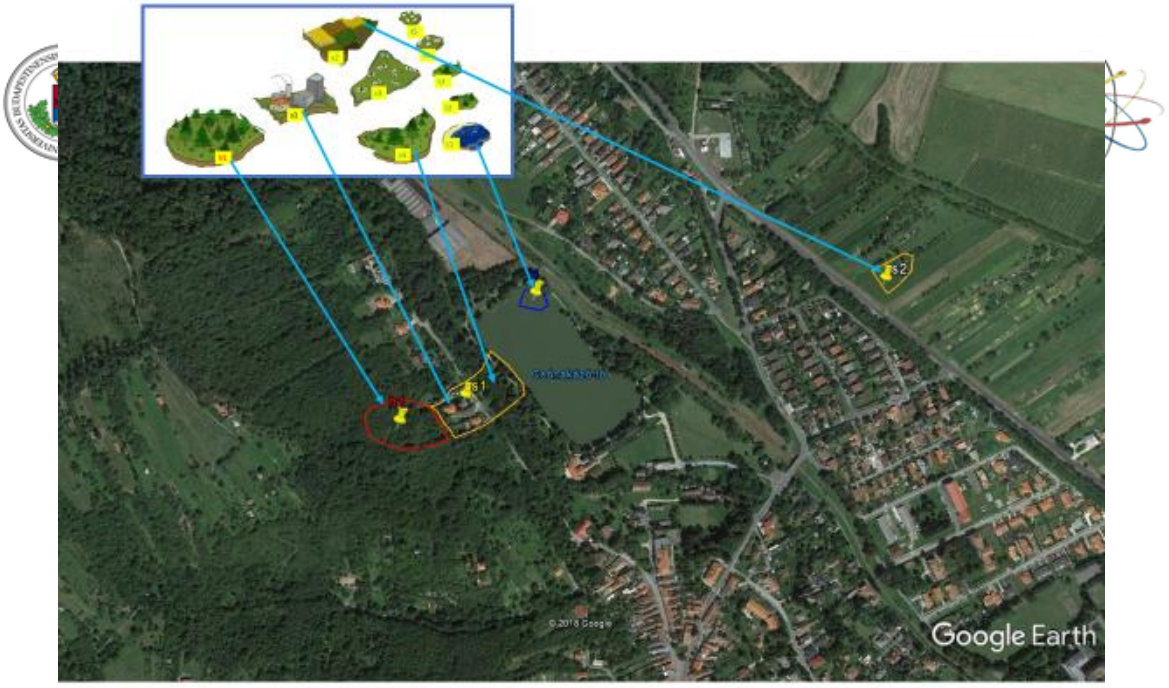

Figure 2. The components of the ecological footprint with real sizes, walked around, and mapped onto the surroundings of the town.

Conclusions

The "*e-co-foot*: E-co-logical Footprint Training - digital resources for online and offline education" project is described here. The project itself is in the making, some of the tasks accomplished, some of them just planned. After the short description of the project, we summarized how this course can be fit into the national curricula, and explained which specific subjects are most fit for this course. The main characteristics of the teaching material has been laid down, and we have shown some methodological examples of how this concept can be best understood, visualized and shared online.

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