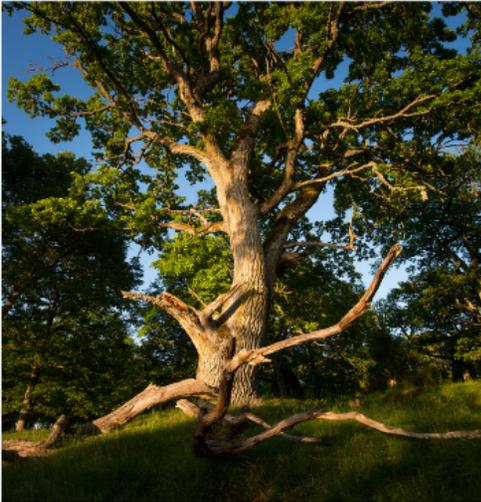


Sustainability - through the Eyes of a Biologist

*Where does the term "sustainability" come from?
How did it change over the last decades?
And what, in this context, can be the role of STEM-teaching*



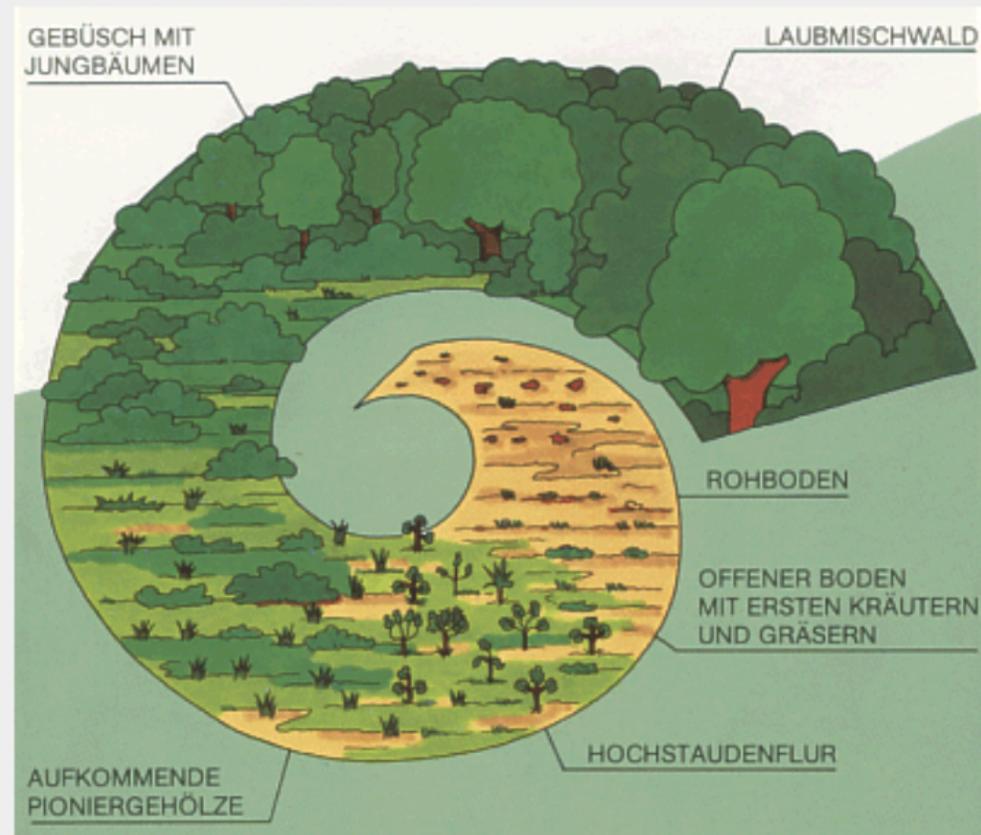
Kupfer, Silber, Blei und Zink

https://www.dfg.de/DFGmedien/Video/022980/022980_01/022980_01_Saturnus_Verfilmung%3BCR-Naturvernichtung



Where does the term "sustainability" comes from?

To understand this, one has to have a little idea about the development and role of the forests.



this process started ca. 8000 yrs ago
in central Europe...

Process of succession

The term based on the fact, that in the 19th century, most of the forests in Europe were gone, due to extensive deforestation for heating melting furnaces, the construction and heating of houses and for agriculture.

As an example: Switzerland.

Übernutzung der Wälder

overuse of the forests...



Buchenlauberte bei Sargans SG um 1900

collecting leaves for bedding in the stable and filling of mattresses



Ziegenherde im Engadin um 1915

let graze herds of domestic animals



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KARA

Übernutzung der Wälder



wood-rafting
Holzdrift auf der
Saane Mai 1894



Übernutzung der Wälder – Folgen

flooding due to deforestation



Lammbachkatastrophe bei Brienz BE Mai 1896

the sustainable use of...

originally this idea is based on...

In 1876, the government of the still young federal state of Switzerland passed the first law aimed at protecting nature: the Forest Act.

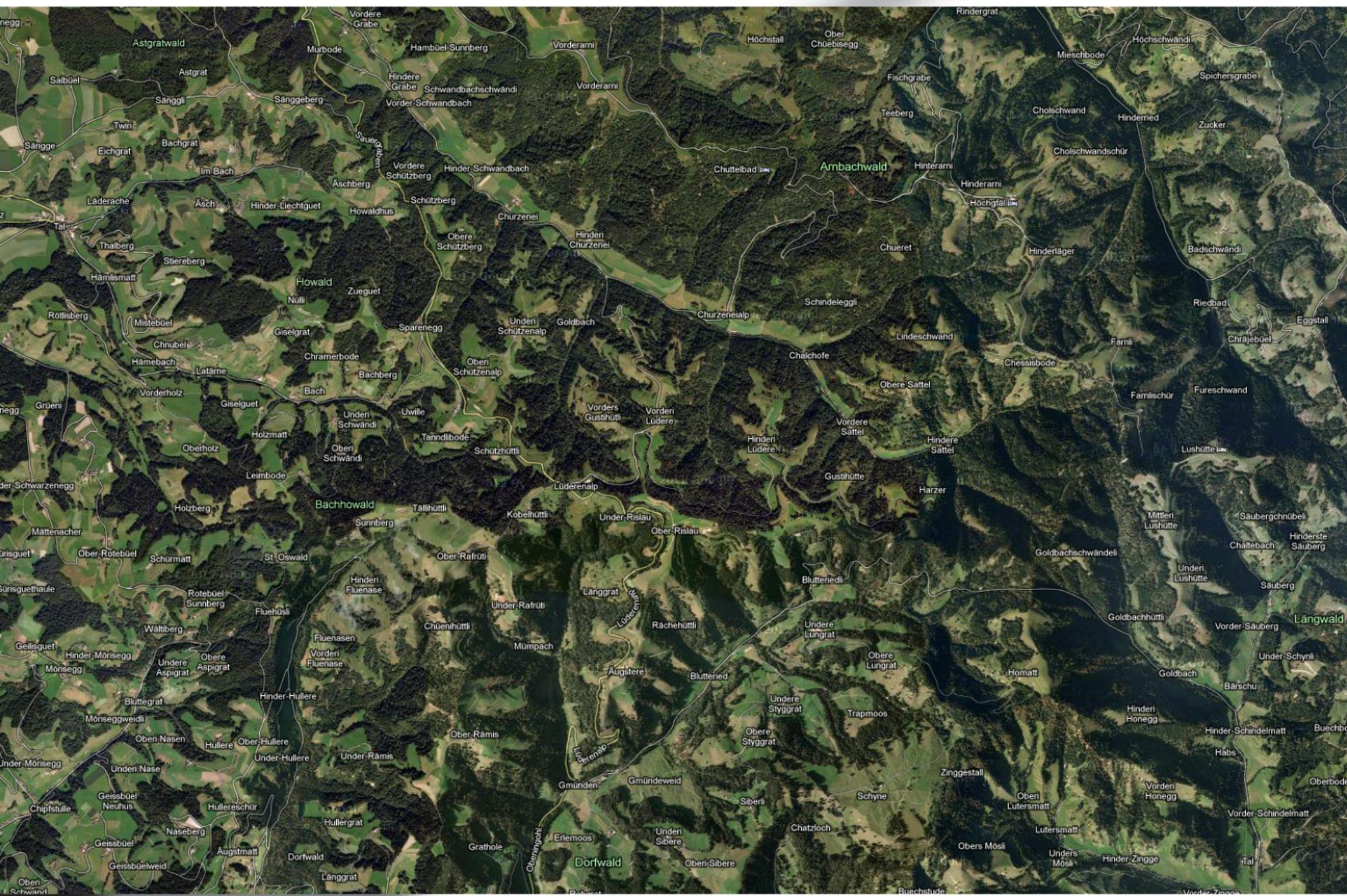
No more leaves were allowed to be collected from the forests
No more animals were allowed to be guided into the remaining forests to graze

and:

above all, *and this is the actual origin of the **term sustainability***

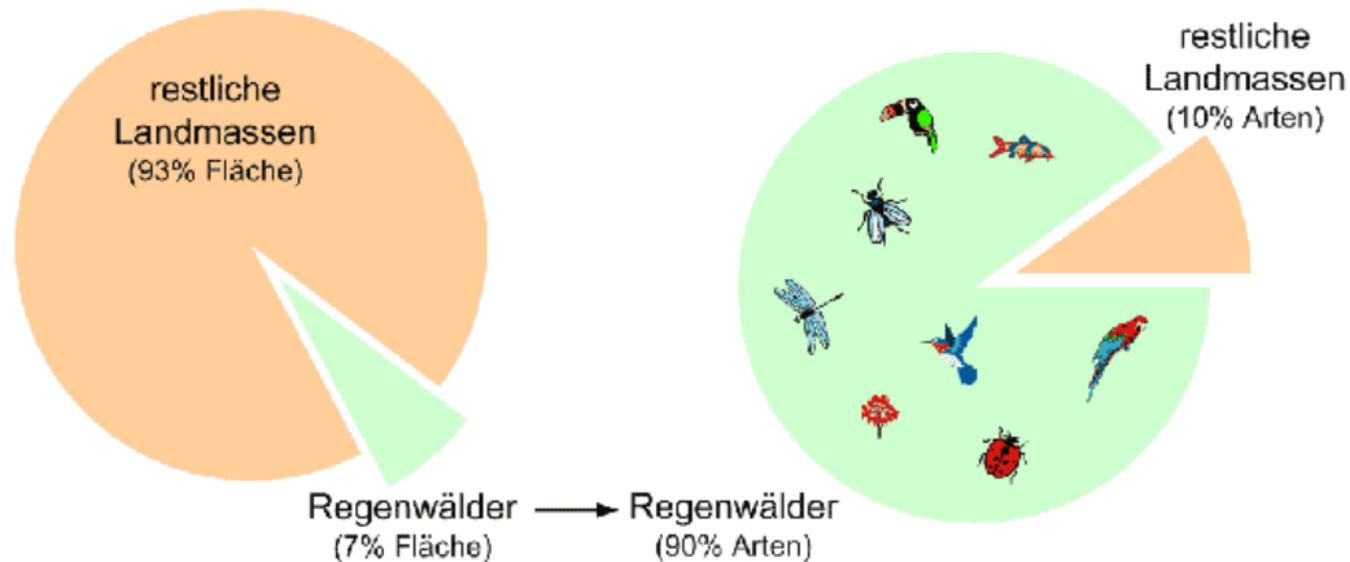
only that much wood was allowed to be felled /cut down, that ***the next generation*** IS ABLE to use the SAME amount for itself.







and a glimpse to the rainforests... which are essential for survival for all of us! and among many other things 100% linked to climate-(change)



this year, Bolivia f.ex. is cutting down 9'000'000 ha of primary forest - but many people think, Covid-19 is the big threat... *sustainable - for that the next generation...*





Albert A. Bartlett:

“The greatest shortcoming of the human race is our inability to understand the exponential function.”



and, another sentence of him:



Believing in a infinite economic growth
on a planet with limited resources
only do economists and idiots.

8 DECENT WORK AND ECONOMIC GROWTH



and:

above all, *and this is the actual origin of the **term sustainability***

only that much wood was allowed to be felled /cut down, that *the next generation* IS ABLE to use the SAME amount for itself.

8 DECENT WORK AND ECONOMIC GROWTH



economic growth - is a oxymoron - is a contradiction in itself to the "aim" towards sustainability!

as some powerful people did realize in the past decades, that the mantra / ideology of economic growth does not mach with the original definition of sustainability, they started with the help of the politics to add other factors / topics to this term. Topics, *which turn the idea of sustainability to a farce.*

(more details about this issue you can read in my blogs)

the aim has to be, to make students understand, in what way the production and consumption of things for daily use or leisure threatens our existence.
This is a very mathematical issue...

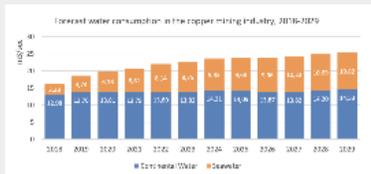
Step 1:
students have to be conscious about, that any object, they possess is made out of this natural existing elements;
(including themselves)
--> *do profit from multidisciplinary teaching!*



though:
facing the facts- just mentioned, this goal itself can not be achieved, if goal 8 remains in its actual meaning.

plant a tree-
on many mining sites no trees will grow any more, as the soil is devastated for ever.

1.2.14. SDG 14 | Life below Water |
Conserve and sustainably use the oceans, seas and marine resources for sustainable development. 38



btw: where is the UN goal to protect our continental water (drinkable water) ??

each product has a certain amount of **gray water** for its production... f.ex.
1 kg of beef-meat uses up 25'000 liter of water
1 T-shirt 2700 liter of water
1 Liter orange juice: 100 Liter , a cup of cafe 20 Liter etc.

step 2:

make them to be aware about the fact, that any object they do have, desire or build, has its own footprint based on the consumption of soil (to gain the needed elements) and of water.

The footprint for a object based on its soil-consumption can be determined and has its own measure:

MIPS --> material input per service unit

--> <https://wupperinst.org/en/a/wi/a/s/ad/585/>



largest open pit copper mine in Canada, BC
48.5 million tonnes of tailings pumped in 2003
... with the impact of "steady growth" you can imagine what this means for today...

Step 1:

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The periodic table is color-coded by groups and properties. A legend for Aluminum (Al) is shown, with its atomic mass (26.98) and atomic number (13) highlighted. The legend includes the following categories:

- Wasserstoff (Hydrogen)
- radioaktiv (radioactive)
- Erdalkalimetalle (alkaline earth metals)
- Metalle (metals)
- Halbmetalle (metalloids)
- Edelgase (noble gases)
- Nichtmetalle (non-metals)
- Alkalimetalle (alkali metals)

I																		VIII									
1,01 1 H																		4,00 2 He									
6,94 3 Li	9,01 4 Be																	10,81 5 B	12,01 6 C	14,01 7 N	16,00 8 O	19,00 9 F	20,18 10 Ne				
22,99 11 Na	24,31 12 Mg	III a	IV a	V a	VI a	VII a	VIII a			I a	II a	13 26,98 Al	14 28,09 Si	15 30,97 P	16 32,06 S	17 35,45 Cl	18 39,95 Ar										
39,10 19 K	40,08 20 Ca	44,96 21 Sc	47,87 22 Ti	50,94 23 V	52,00 24 Cr	54,94 25 Mn	55,85 26 Fe	58,93 27 Co	58,69 28 Ni	63,55 29 Cu	65,39 30 Zn	69,72 31 Ga	72,61 32 Ge	74,92 33 As	78,96 34 Se	79,90 35 Br	83,8 36 Kr										
85,47 37 Rb	87,62 38 Sr	88,91 39 Y	91,22 40 Zr	92,91 41 Nb	95,94 42 Mo	97,91 43 Tc	101,0 44 Ru	102,9 45 Rh	106,4 46 Pd	107,9 47 Ag	112,4 48 Cd	114,8 49 In	118,7 50 Sn	121,8 51 Sb	127,6 52 Te	126,9 53 I	131,3 54 Xe										
132,9 55 Cs	137,3 56 Ba	175,0 71 Lu	178,5 72 Hf	180,9 73 Ta	183,8 74 W	186,2 75 Re	190,2 76 Os	192,2 77 Ir	195,1 78 Pt	197,0 79 Au	200,6 80 Hg	204,4 81 Tl	207,2 82 Pb	209,0 83 Bi	209,0 84 Po	210,0 85 At	222,0 86 Rn										
223,0 87 Fr	226,0 88 Ra	262,0 103 Lr	261,1 104 Rf	262,1 105 Db	266,1 106 Sg	264,1 107 Bh	269,1 108 Hs	268,1 109 Mt	273,1 110 Ds	272,1 111 Rg																	

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Foto: www.flickr.de



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Foto: www.floza.it



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Foto: www.alrosa.ru





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step 3:

when once you've got the students in this "thinking mode" of MIPS and the impact of production and consumption, you can start playing around and adding sustainable tasks to your specific subject / issue of the lessons.

I was mentioning 4 examples in my blog: there are dozens more:

for ex:

make them programing the daily consumption of soil in their country- and extrapolate it to the future:

--> for how many years

undeveloped soil will last?

Does this fit with the original idea of sustainability?

let them calculate the MIPS of e-cars: are those sustainable?

what if the meat consumption still increases and therefore the number of cows, too...

hydro-power: really sustainable?

and so on...

there are many many other topics fitting in your curriculum of math/ physics and engineering-

I'm happy to show you the clues...

SUSTAINABLE DEVELOPMENT GOALS **15** LIFE ON LAND



PLANT A TREE AND HELP PROTECT THE ENVIRONMENT.
Forests are home to more than 80% of all terrestrial species of animals, plants and insects.

Goal 15: Life on Land

though:
facing the facts- just mentioned, this goal itself can not be achieved, if goal 8 remains in its actual meaning.

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Foto: www.afros.lu



in summary:
what can /should the additional aspect of Sustainability in STEM
contribute to a hopefully still possible future for the Homo sapiens
sapiens?

the "savant".
the task to teach and guide
in a *systemic way*.

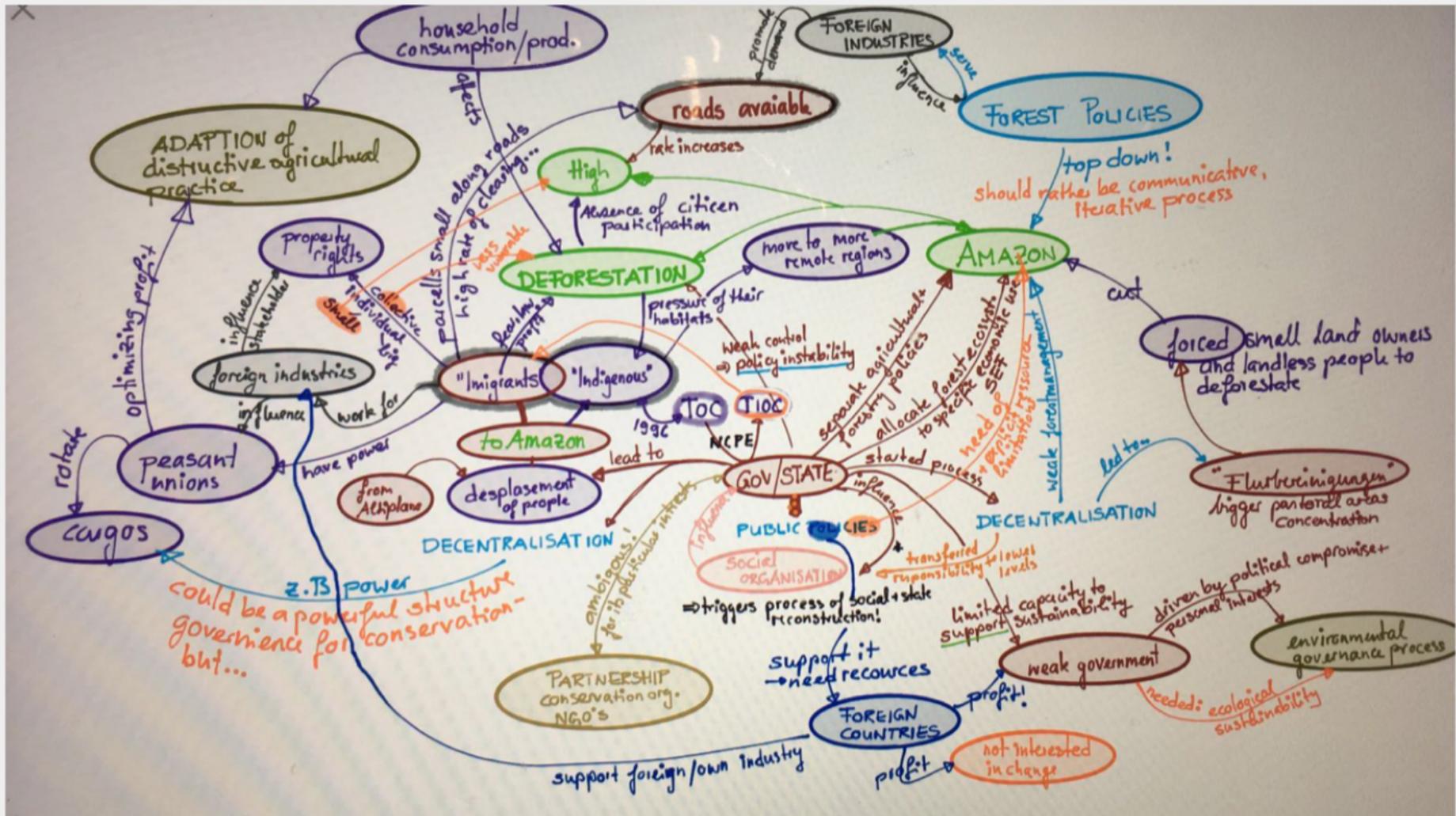
(...) over decades by influential
we face today.

knowledge of a systemic,

it should become compulsory, to teach
in an inter- and multidisciplinary manner

We only can tackle the hurdles in the
systemic, multidisciplinary way.

we should not look after solutions
products or technology - as - (I hope)



that fore - they should be taught in concept-mapping.

it should become compulsory, to teach in a inter- and multidisciplinary manner .

We only can tackle the hurdles in this systemic, multidisciplinary way.

we should not look after solutions in products or technology - as - (I hope you got the point by now)- we do not have enough natural resources to build all this technology for much longer.

Instead, we should get conscious, that modern men has to change its attitudes.

It's quite non-sense to work on low-energy lights and machines, if the consumption of energy is still growing.

MAN has to sustain; and de-grow.

And economy has to change the ideology of growth.

SHORT:

we are forced to throw out our traditional convenient values



1.2.4. SDG 4 | Quality Education |
Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

we are forced to throw out our traditional convenient values

4
QUALITY
EDUCATION



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