

Lecture 6
(Block I: What is unsustainable today (5))
Water, soil and our industrial agriculture

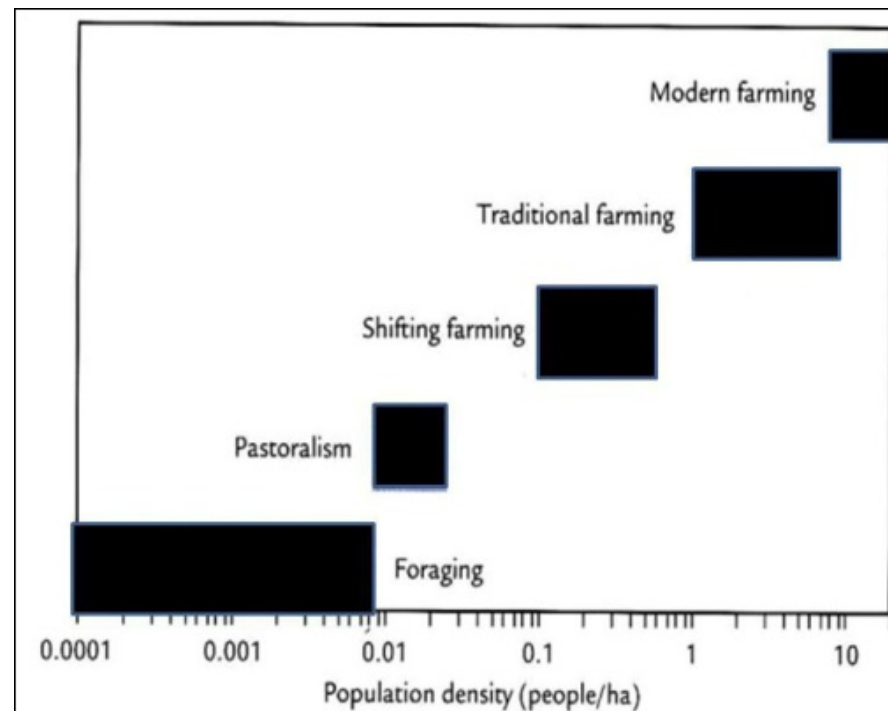
- **Carrying Capacity: a function of available food**
= good water + good soil + solar energy and “biology”
- **Water and water quality: today and tomorrow?**
- **Soil and soil quality: today and tomorrow?**
- **Overview: todays food supply system.**
Our industrial agriculture system functions thanks to cheap fossile energy resources (especially oil for transports), by first principles this system is unsustainable!
- **Which future for our food supply?**
Dr. Angelika Hilbeck ETH Zurich
<http://www.tdlab.usys.ethz.ch/people/person-detail.html?persid=95380>
- **Outlook: “Erst kommt das Fressen und dann die Moral”**
with english subtitles <https://www.youtube.com/watch?v=WVS01YP9k0k>

Carrying Capacity: a function of the available food

Thesis 1: Thanks to the industrial agriculture sufficient food exists and nobody should be hungry today, but roughly 1 billion humans (1/7) have not enough to eat. Poverty and hunger exist even in rich OECD countries.

“Experts(?) say: about 2.5 billion humans are confronted with the “hidden hunger” problem. “Arm aber nicht sexy Experten warnen vor verborgenem Hunger” <http://tinyurl.com/oj94sgo> and a 2min trailer <http://www.magpictures.com/aplaceatthetable/> and full movie https://www.youtube.com/watch?v=EKqdL7A_aUI

“50 million people in the U.S.-one in four children-dont know where their next meal is coming from, despite our having the means to provide nutritious, affordable food for all Americans.”



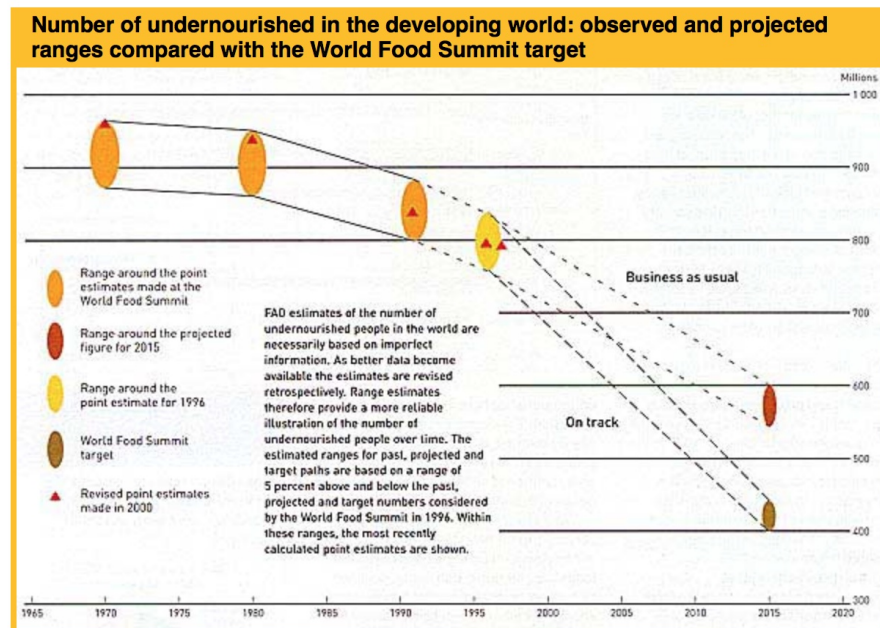
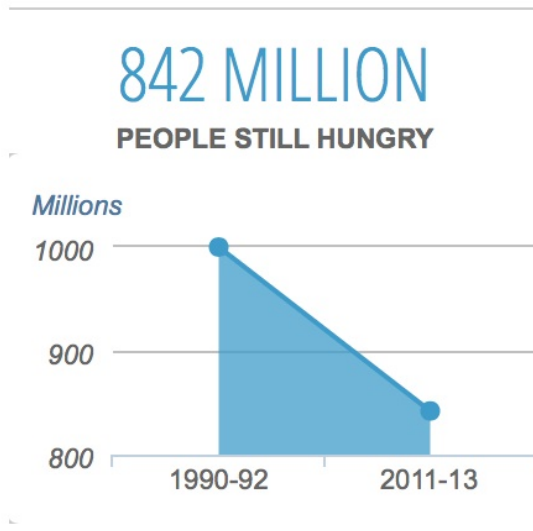
source <http://tinyurl.com/nbxxmeg>

Millennium Goals: Reducing “hunger by half”

FAO 2014 (how to cheat with numbers?):

<http://www.fao.org/publications/sofi/en/>:

“A total of 842 million people in 2011 to 2013, or around one in eight people in the world, were estimated to be suffering from chronic hunger, regularly not getting enough food to conduct an active life. This figure is lower than the 868 million reported with reference to 2010 to 2012. The total number of undernourished has fallen by 17 percent since 1990 to 1992.”



sources: FAO <http://faostat3.fao.org/faostat-gateway/go/to/home/E> und
The state of food insecurity in the world 2000...http://www.fao.org/docrep/x8200e/x8200e02.htm#P2_8

Remember Chief Joseph: *“I have heard talking and talking but nothing is done”*

<https://www.youtube.com/watch?v=41UL46bvIa0>

Carrying Capacity + Ghost Carrying Capacity: Sustainable and un-sustainable production of food

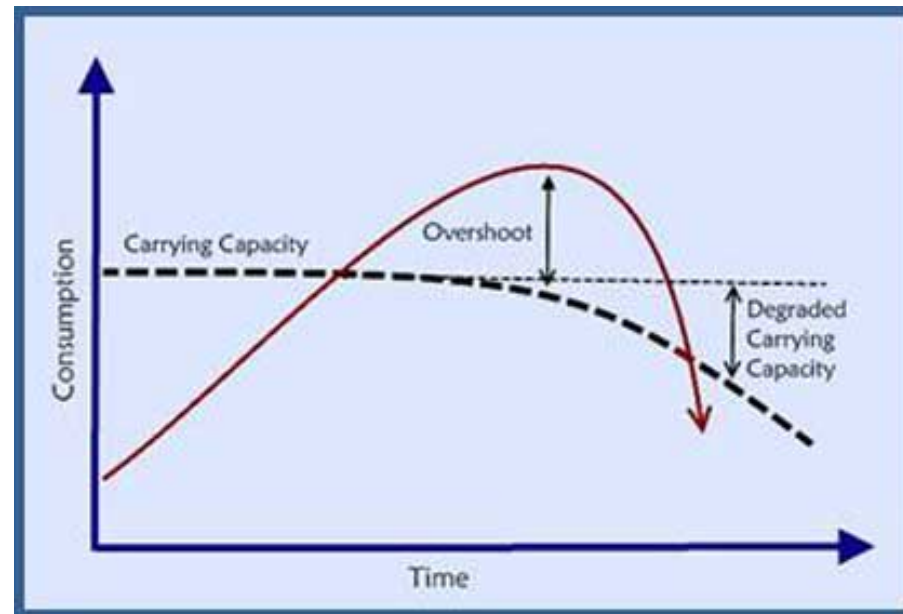
Thesis 2: industrial agriculture obtains large yields using destructive exploitation (reduction) of the natural capital!

reducing soil and water quality and destroying biodiversity.

Thesis 3: industrial agriculture (modern farming) is totally unsustainable.

every calorie of food contains roughly 10 “oil (fossile)” calories from production, transport and distribution.

How large is our real overshoot (once oil is gone)



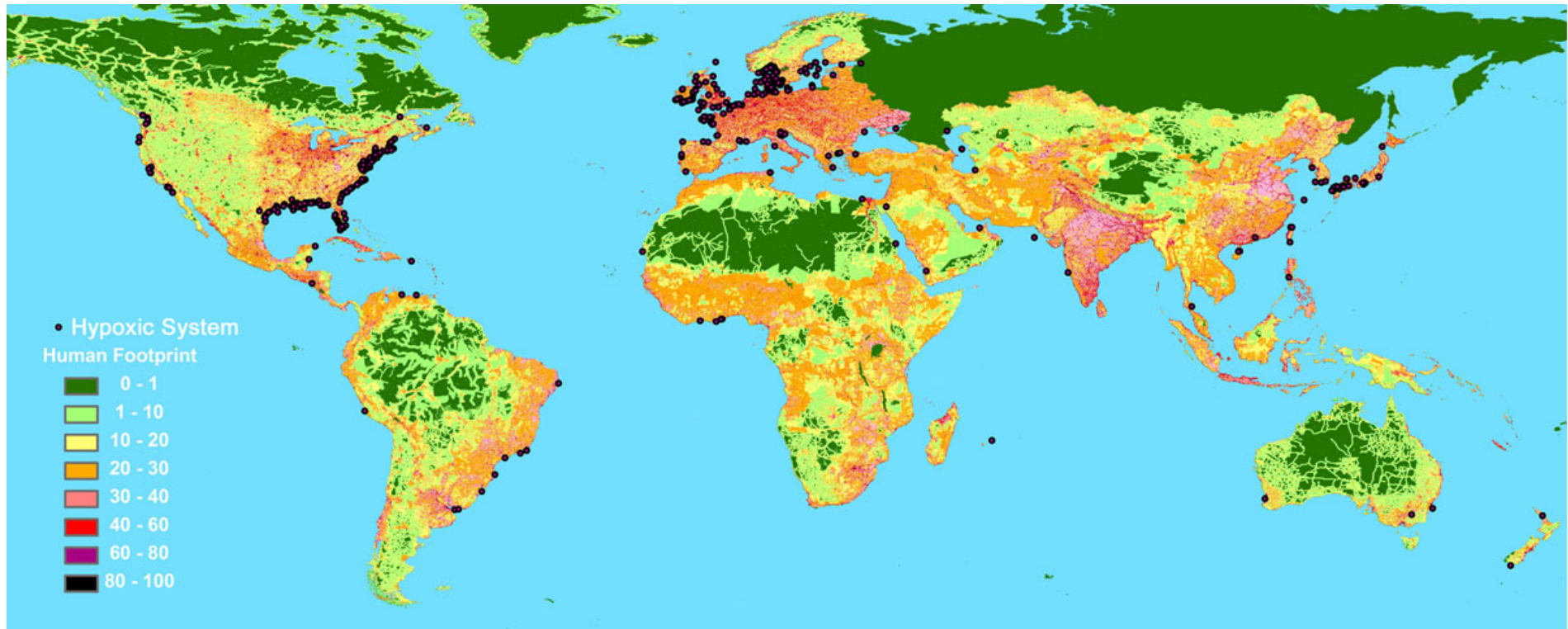
more under W. Catton Overshoot http://en.wikipedia.org/wiki/William_R._Catton,_Jr. and <http://www.youtube.com/watch?v=7bXXQ1vVdsI>

Water and water quality: today and tomorrow?

We (in Switzerland) are sitting at the relative clean water source (fortunately) but..

fertilisers, waste and resources are “flushed” down the rivers: **European river deltas became death zones.**

the Rhone <http://www.guardian.co.uk/environment/2008/feb/23/pollution.water>

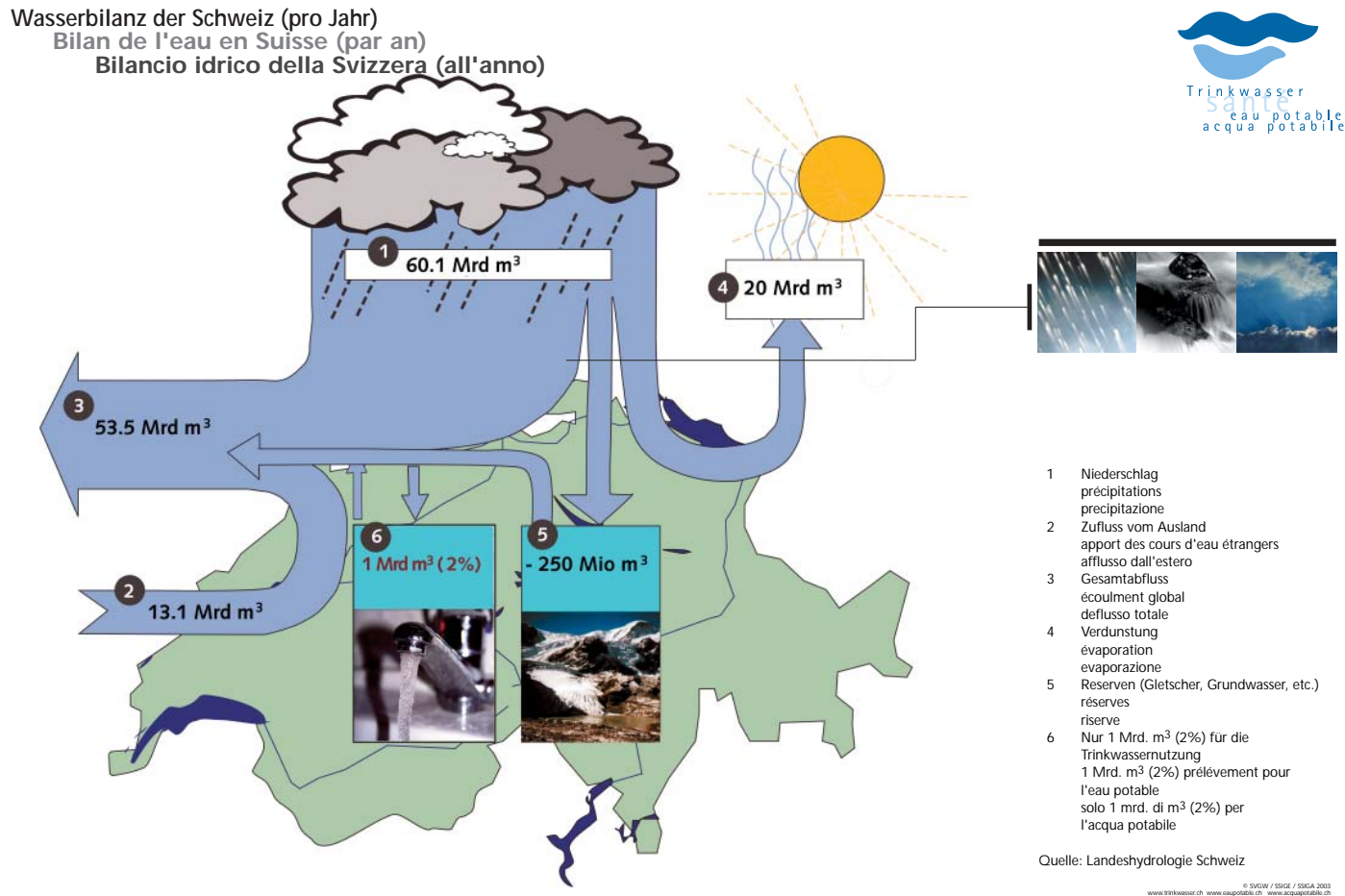


<http://www.scientificamerican.com/article.cfm?id=oceanic-dead-zones-spread>

Water and water quality in Switzerland (1)

Water: a huge natural capital from Switzerland. The sustainability principle from the Suisse constitution demands:

We have to protect it under all circumstances and must enlarge it again. No further risks for short term profits!

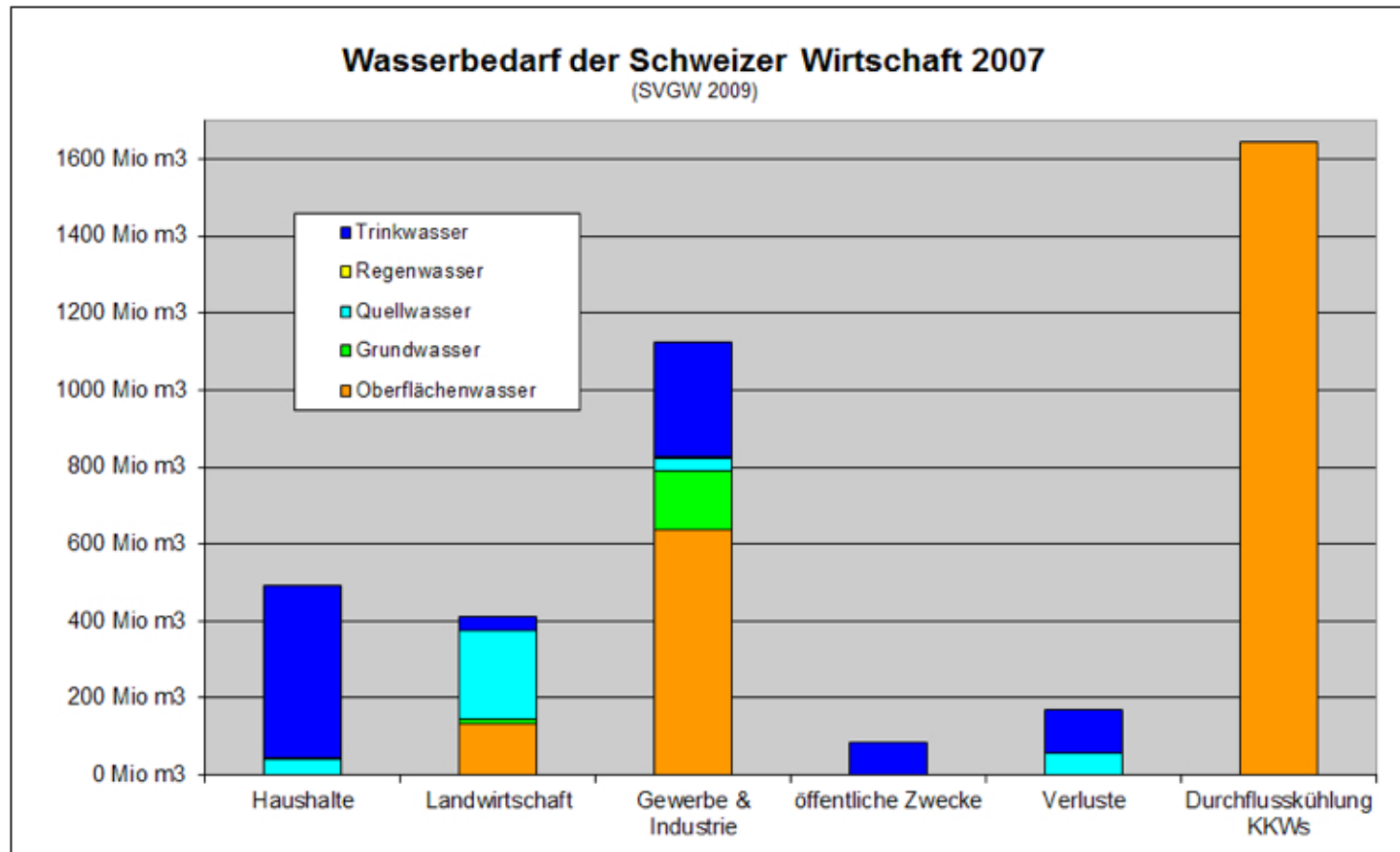


Water and water quality in Switzerland (2)

Intensive water/energy use has reduced/eliminated the richness from fish! hundred years ago: about 10 000 kg of salmons were fished every year.

<http://www.bafu.admin.ch/tiere/09262/10022/index.html?lang=de>

<http://www.wwf.ch/de/projekte/schweiz/wasserprojekte/lachs/>



http://www.trinkwasser.ch/dt/frameset.htm?nav_00.html~leftFrame

Water and water quality in Switzerland (3)

Clean water in Switzerland is not for free (≈ 1.80 CHF/1000 litre):
 162 litre per person and day (30% for toilet flushing)

more at: http://www.trinkwasser.ch/dt/frameset.htm?nav_00.html~leftFrame

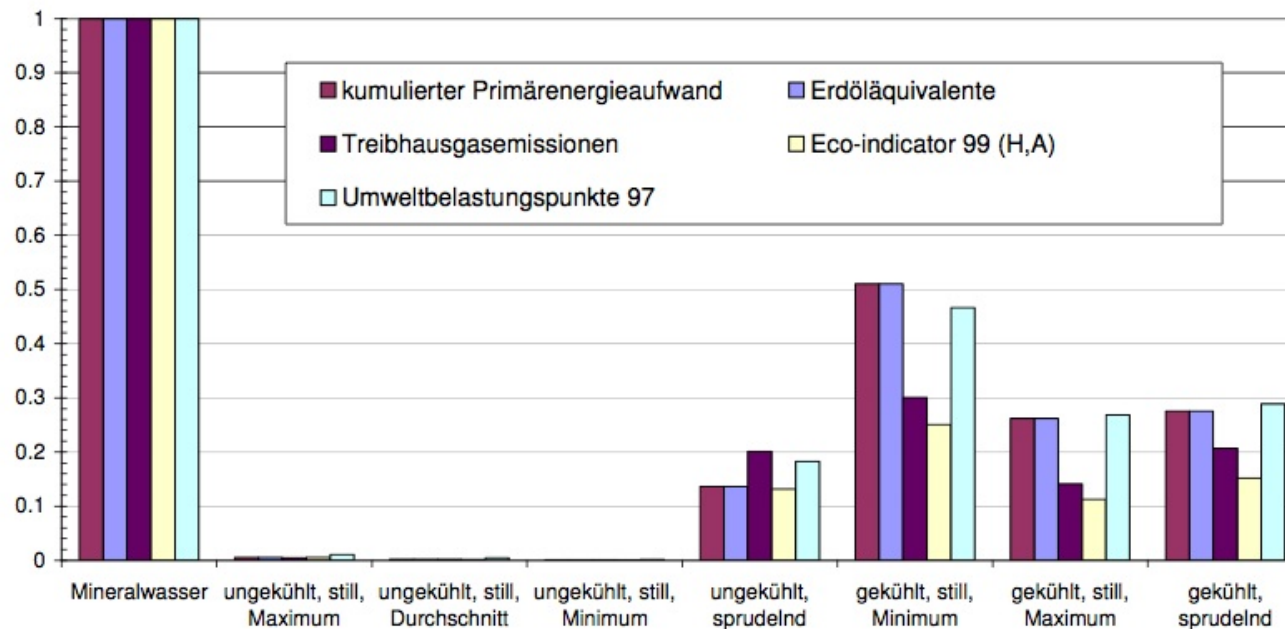


Fig. 4.2 Relativer Vergleich der Umweltbelastungen von Mineralwasser und Hahnenwasser. Die Höhe des Balkens gibt die Umweltbelastungen der Hahnenwasservariante im Vergleich zur entsprechenden Variante für Mineralwasser an

http://www.trinkwasser.ch/dt/html/download/pdf/oekobilanz_d.pdf

Water equality global perspectives? (1)

a sustainable use of water resources according to

http://www.trinkwasser.ch/dt/frameset.htm?nav_00.html~leftFrame Quote:

- *do not use more raw water than nature provides.*
- *Human water use (quality reduction) must always(!) allow natural regeneration. Tab water quality has to be achieved for "ever" (through water protection and environmental controls).*
- *Water security for a long time (renew infrastructure, continuous investments etc)*
- *Water supply have to be affordable for all (rich and poor): monetary price limits? what about clean water for wildlife? (who pays?)*

Questions:

- (1) *How to quantify and guarantee those principles beyond cantonal and country borders?*
- (2) *do other species have a right for clean water in rivers lakes?*

Last Sunday 22.3.2015 was **world water day** and so what

"The planet is facing a 40% shortfall in water supply by 2030, unless we dramatically improve the management of this precious resource. This is the unavoidable conclusion reached in the 2015 United Nations World Water Development Report, which was launched on 20 March in New Delhi"

<http://tinyurl.com/p77dt5x>

Water quality: global perspectives? (2)

Water a problem in the distant future? See this Nature (Sep. 2010)

http://www.nature.com/nature/journal/v467/n7315/fig_tab/nature09440_F1.html

“We find that nearly 80% of the worlds population is exposed to high levels of threat to water security.”

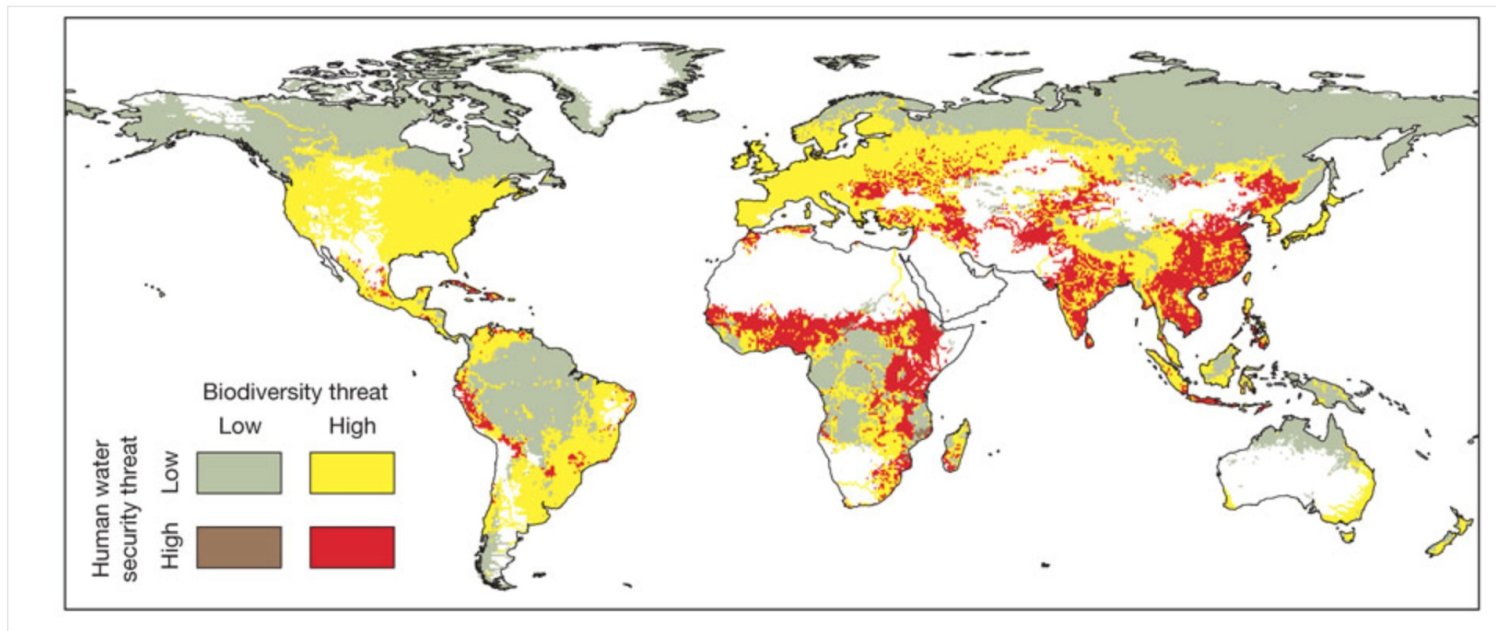
http://www.nature.com/nature/journal/v467/n7315/fig_tab/nature09440_F6.html

From

Global threats to human water security and river biodiversity

C. J. Vörösmarty, P. B. McIntyre, M. O. Gessner, D. Dudgeon, A. Prusevich, P. Green, S. Glidden, S. E. Bunn, C. A. Sullivan, C. Reidy Liermann & P. M. Davies

Nature 467, 555–561 (30 September 2010) | doi:10.1038/nature09440



Soil erosion risk in Europe (2050)?

Europe: erosion and “desertification” many studies and maps

<http://www.env-edu.gr/Documents/Soil%20Erosion%20Risk%20in%20Europe.pdf>:

our praised agriculture: a problem!

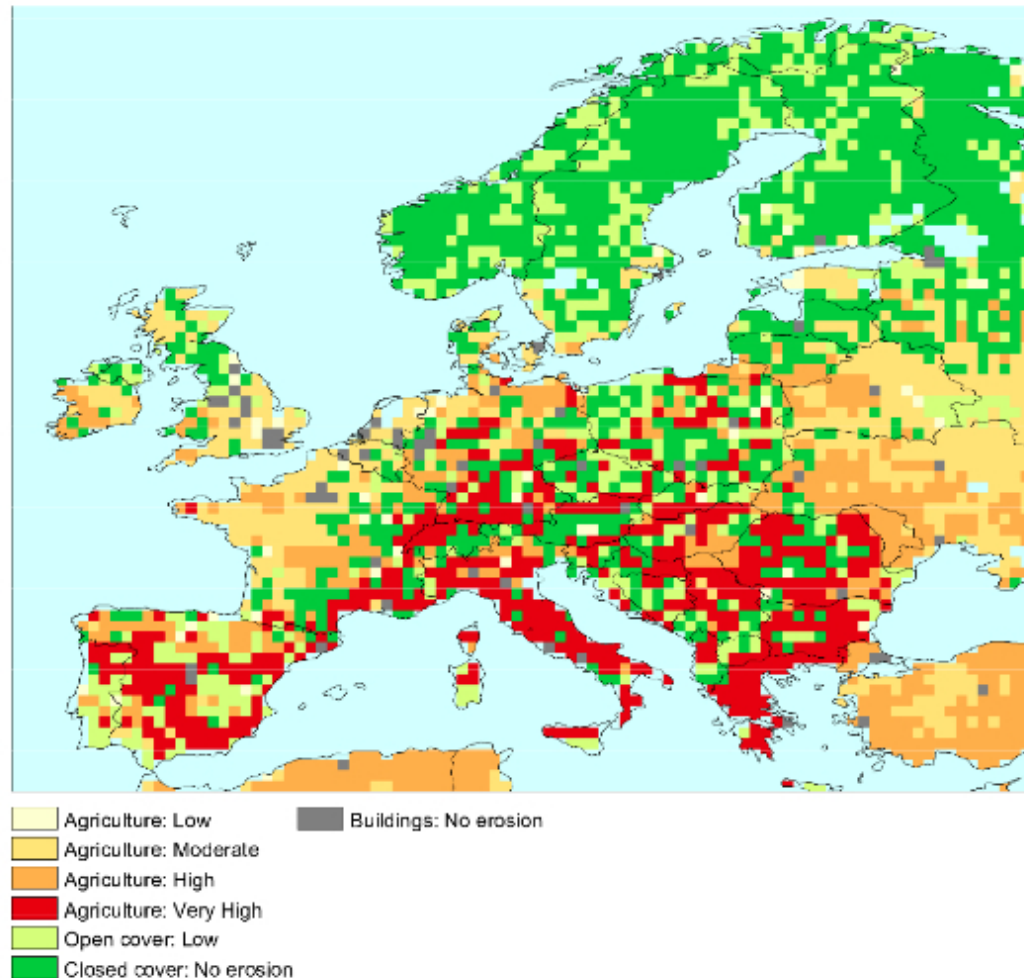
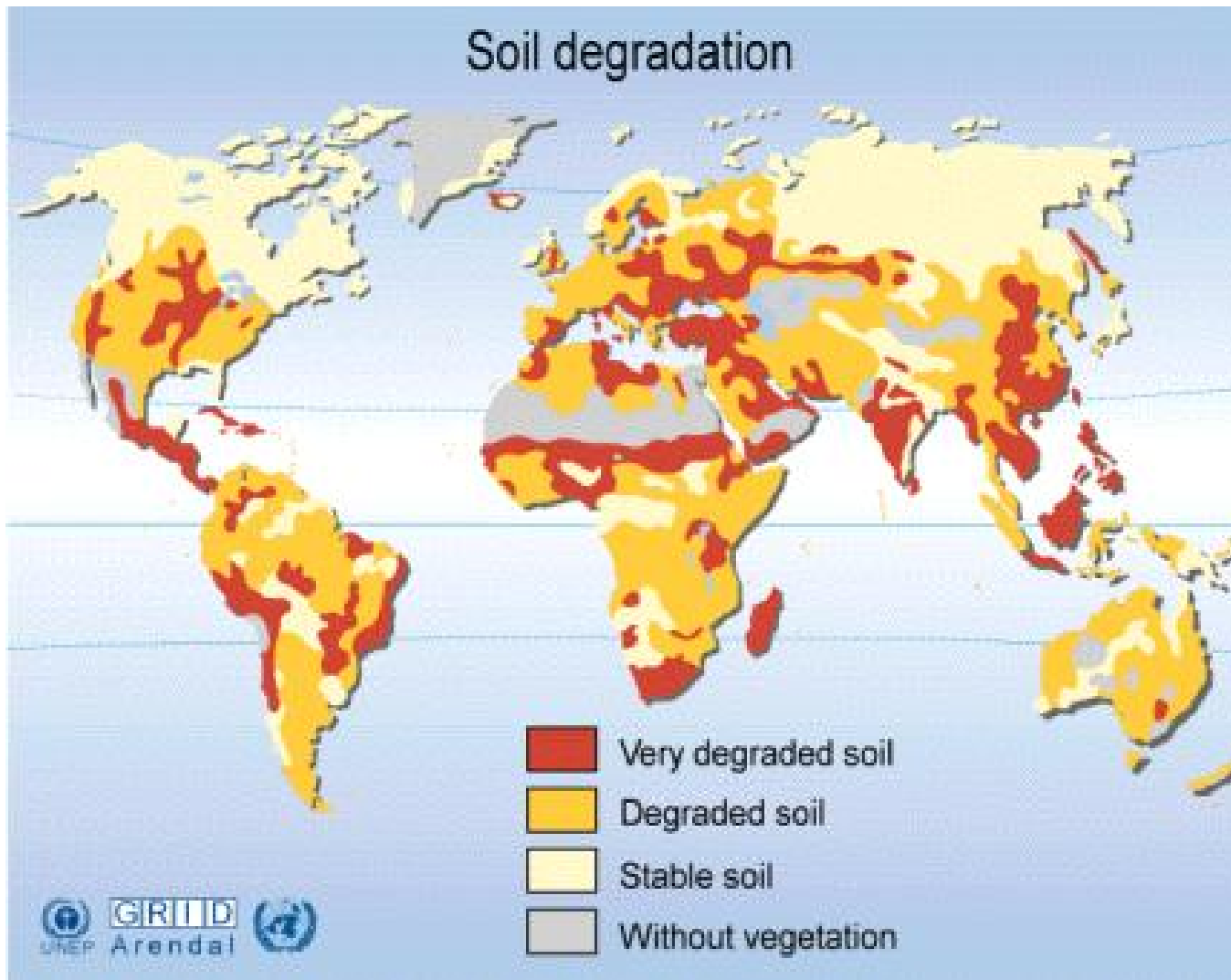


Figure 3.2. Water erosion vulnerability for 2050, according to the baseline scenario by RIVM (RIVM, 1992).

Local and global “desertification” ? (1)

plenty of soil erosion and desertification studies

“alarming” and confusing (at least for a single physicist)!



Local and global “desertification” ? (2)

Example: “State of the World’s Land and Water Resources for Food and Agriculture (SOLAW)”

many details here <http://www.fao.org/nr/solaw/solaw-home/en/>

*“By 2050, food production is projected to increase by about 70 percent globally and nearly 100 percent in developing countries. This incremental demand for food, together with demand from other competing uses, will place unprecedented pressure on many agricultural production systems across the world. **These ‘systems at risk’ are facing growing competition for land and water resources and they are often constrained by unsustainable agricultural practices.**”*

in the words of the FAO Director-General (15.3.2013)

<http://www.fao.org/news/story/en/item/172064/icode/> He said that FAO has developed new strategic objectives to respond to emerging global trends and challenges. These strategic objectives are: **ending hunger and malnutrition; producing sustainably; reducing rural poverty; improving food systems and their fairness; and increasing resilience to external shocks.**

can you guess the older FAO strategies?

What the FAO experts perhaps want to tell us (with my own words):

- (1) **“the future of global food supply is in danger, everywhere”**
- (2) **“We, from the FAO, have everything under control: “don’t worry be happy”!**
- (3) **“In case we made wrong decisions: It is your mistake, we warned you!”**

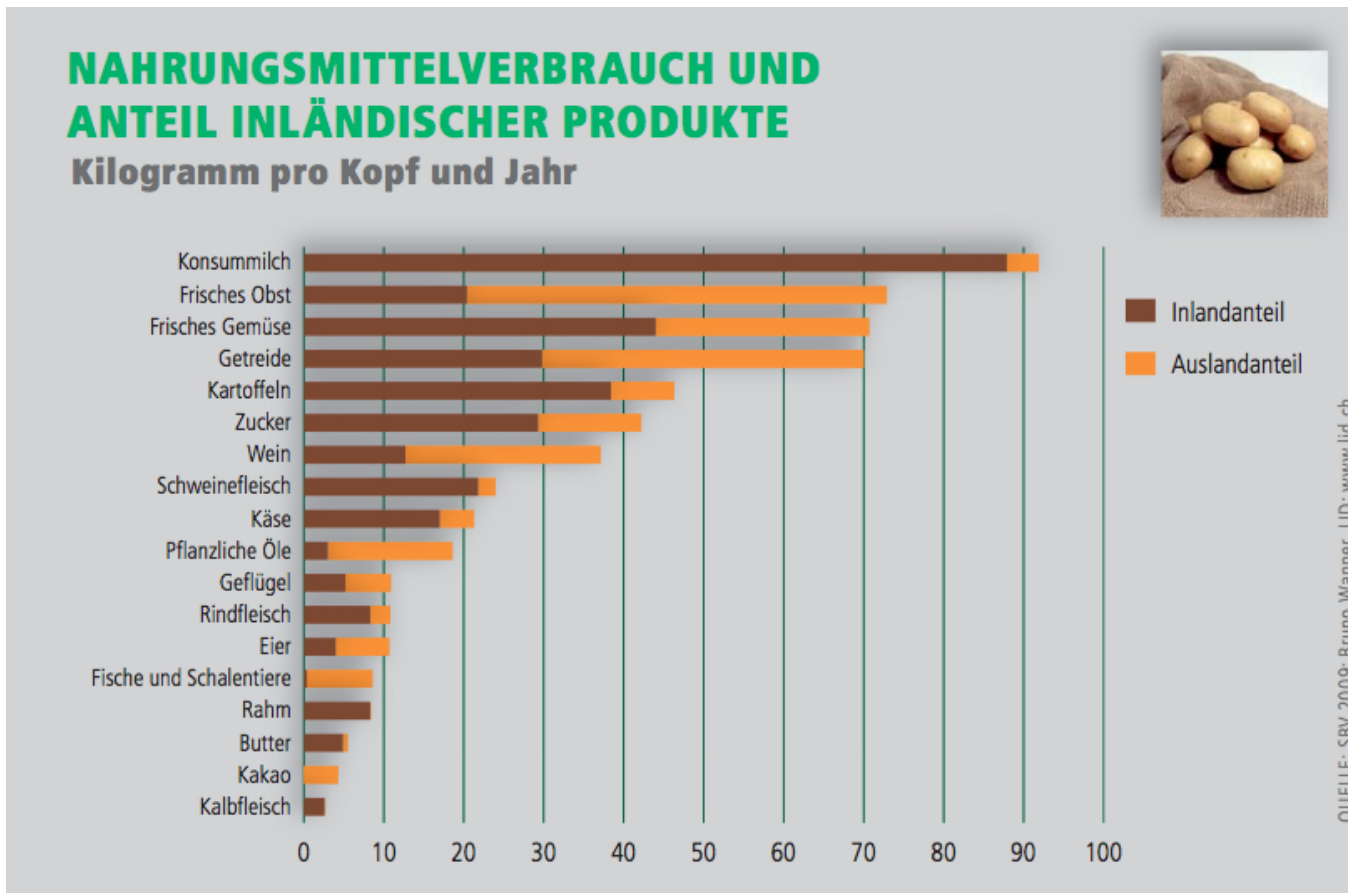
Oxfam (and many other NGO’s) understands the message like that:

“The global food system is broken. It’s not just drought. Or famine. Or a bad harvest. A whole host of interlinked factors such as climate change, land grabs, food price spikes and intensive farming are stopping one billion people worldwide from having enough to eat.”

<http://www.oxfam.org.uk/get-involved/campaign-with-us/find-an-action/join-grow>

Food safety and consumption in Switzerland today:

- (1) Productive industriell agriculture in difficult and limited area.
- (2) About 50% of all food is imported (Ghost agriculture in other countries).
“Today we can buy our food in foreign countries: What will happen tomorrow?”
- (3) Reduction of the “Know How”: 359 000 farmers (1975) to 167 000 farmers today (2009).
- (4) Reduction of agricultural areas (breed and feed wheat): 212000 ha(1990) to 153000 ha(2009).



more at: <http://www.landwirtschaft.ch/de/wissen/agristatistik/>

Suisse food supply tomorrow? (1)

In case we “want” a development towards sustainable living:

“Erst kommt das Fressen und dann die Moral”

http://www.youtube.com/watch?v=j_KiMgdSCII

Rising energy (oil) prices → increasing prices for food!
→ **need to reduce food import dependence**

(1) replace industrial monoculture farming with local biological gardening and farming.

(2) Research and development of sustainable methods: permaculture, Forest Gardens, Biointense Gardening etc ..”

(2) Increasing the independent food supply and its quality through practical experiments

(this can be fun even for physicists!)



Local food supply tomorrow? (2)

In case we “want” a “development towards sustainable living”:

What is wrong with this “food” model for my village: (my) Thoiry (France) (3000 ha with 5000 inhabitants) about 200 people/km².

Achieving up to 80% self-sufficient local sustainable food production!

Minimal requirements: 100 ha productive land only:

100 kg fruits (30-40 m²), 100 kg vegetables (30-40m²) and 50 kg potatoes (20m²) per person and year.

- Fruits: local community “self service” food forests with large varieties of fruit trees and bushes. Fruit trees after 5-10 years 2-3 kg/m² → 50m² per person and 250 000 m² = 25 ha.
- Individual 100m² vegetable garden space for each “family” another another 30 ha.
- Farming and dairy farming (delivering direct Thoiry milk products (1500 liter/day with 75 cows) plus some meat byproducts? another 50 ha.
- Some community farmed “potatoes” 10-20 ha.