



Growth – A Reality Check

**Transition Brockville
January 2015**

Imagine this case ...

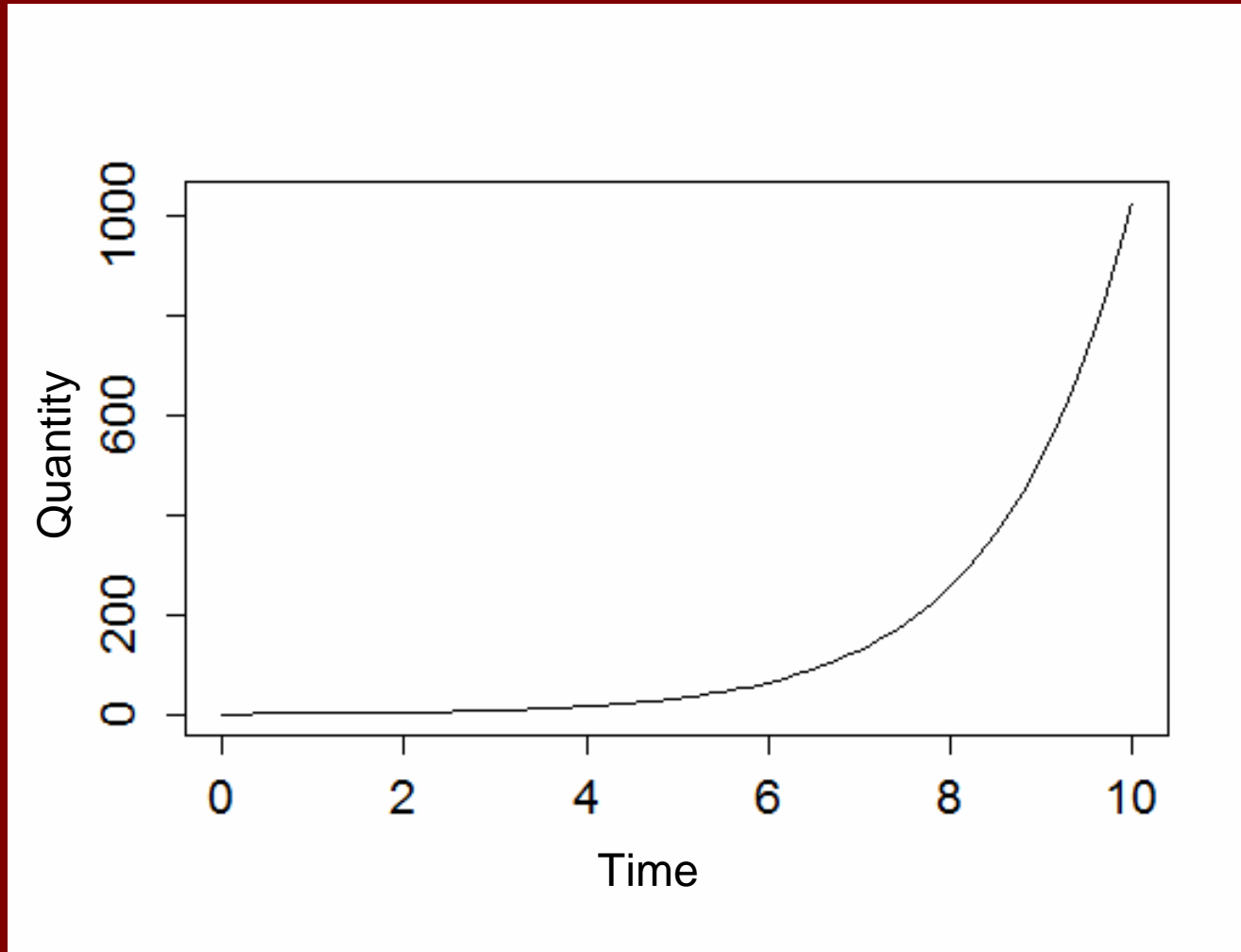
- This room is water-tight
- A single drop from my magic eye-dropper will double in size every minute
- I release a drop at midnight tonight

Q: How long do I have to escape? Minutes? Hours? Days?

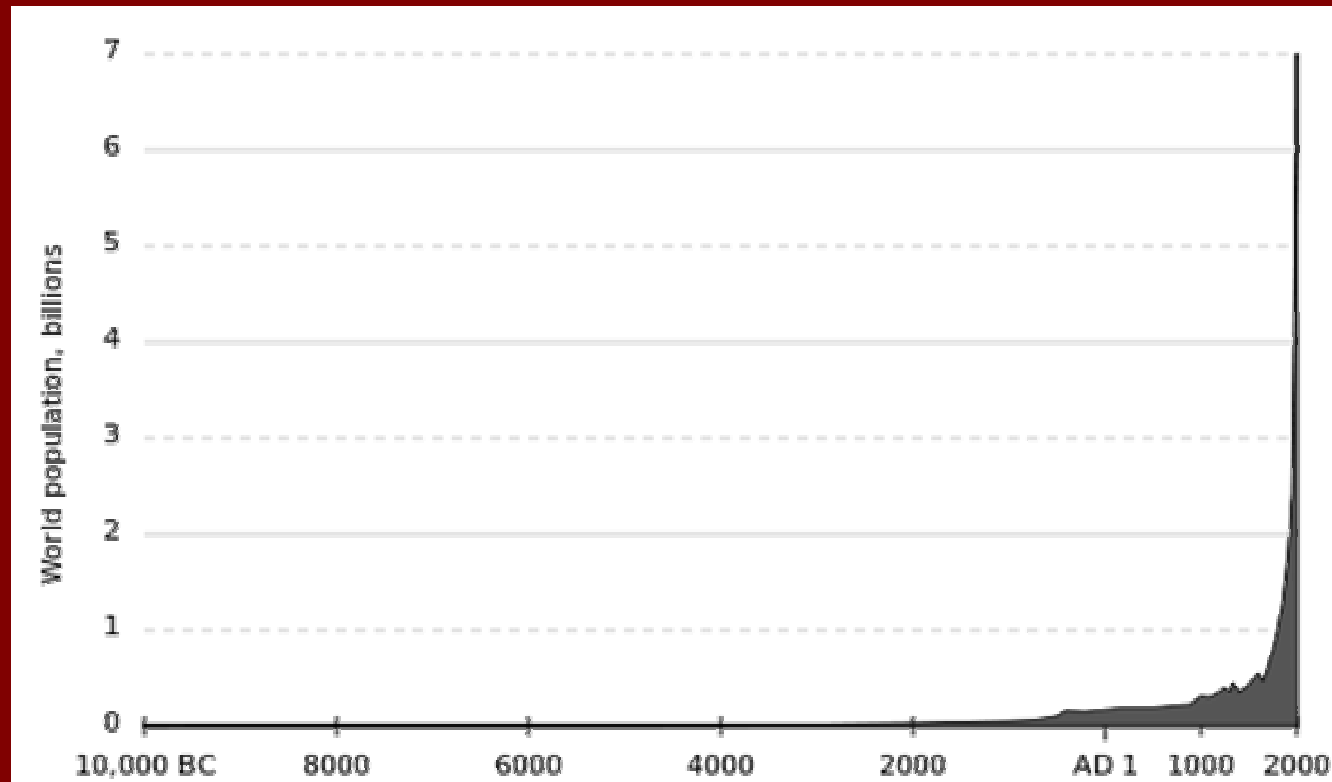
A: **49 minutes**. At 12:49 a.m. the room will be FULL!

- The **first 44 minutes** fills just **3%** of the room
- The **last 5 minutes** fills the remaining **97%**

The Exponential Curve

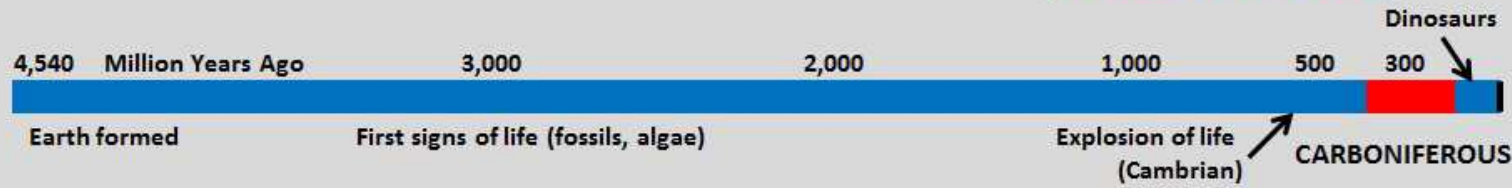


The Exponential Curve: Population



HUMANS AND ENERGY - A TIMELINE

FORMATION OF MODERN ENERGY SUPPLY (FOSSIL FUELS)



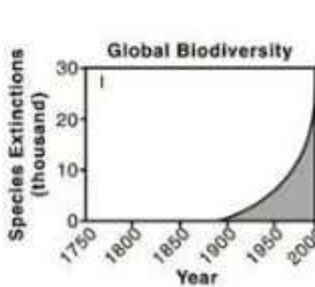
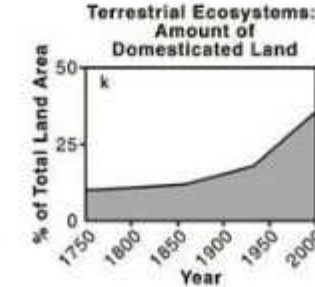
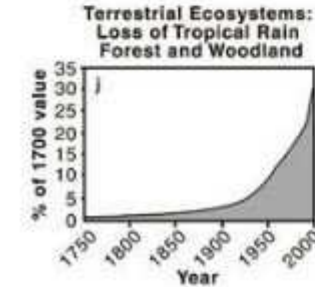
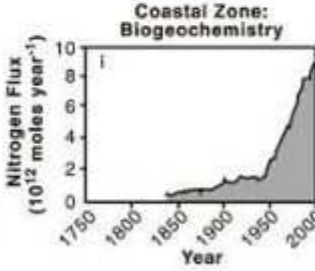
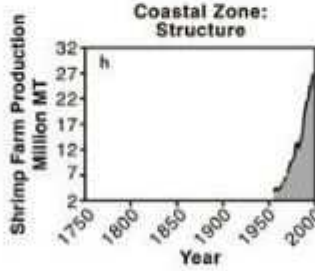
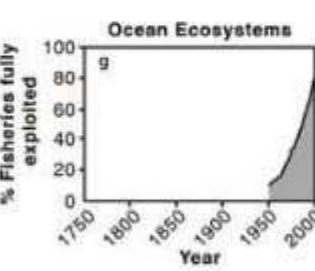
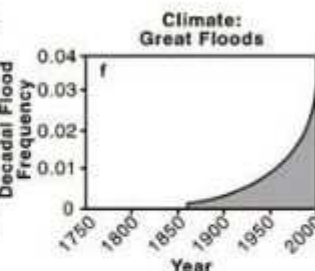
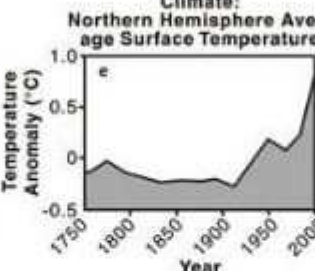
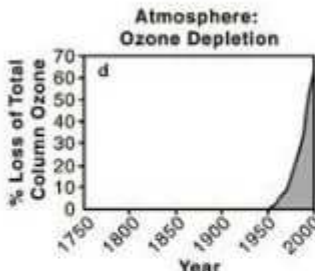
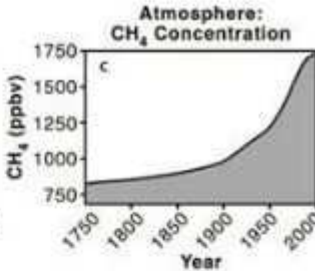
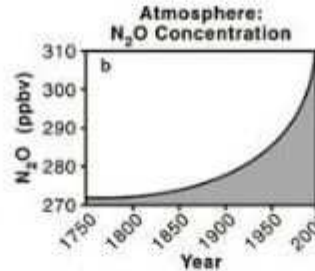
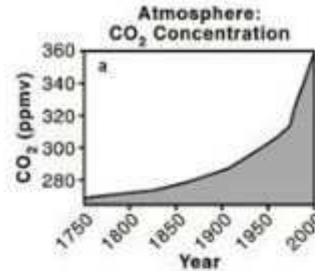
FORMATION OF MODERN ENERGY DEMAND (HUMAN BRAIN)



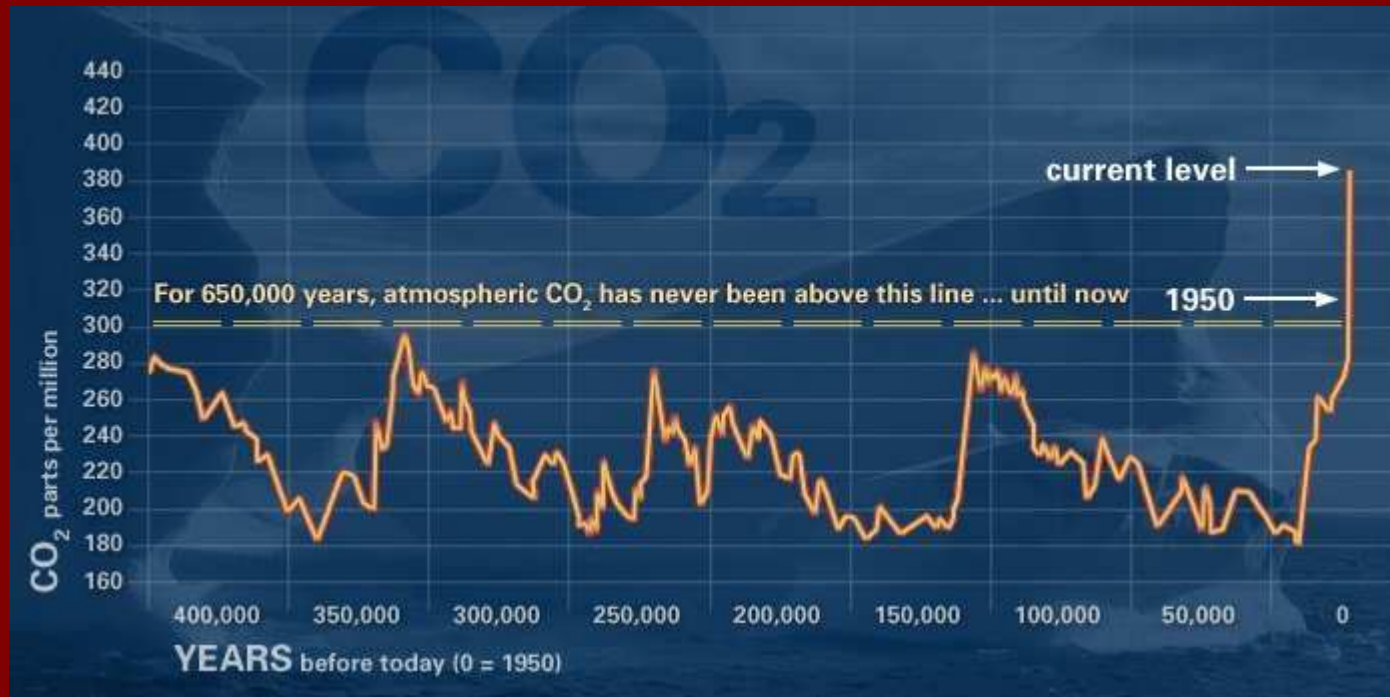
INTERSECTION OF ENERGY SUPPLY AND DEMAND



Graphic adapted from Dr. William Stanton



Carbon Pollution



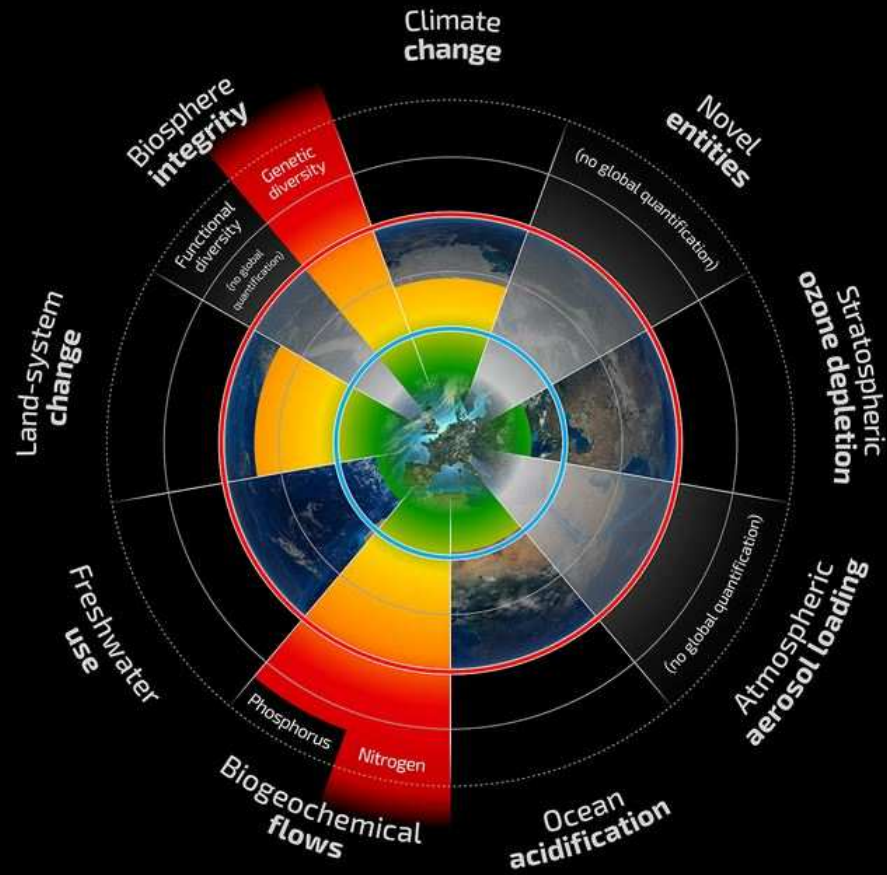
Exponential Function:
a mathematical construct
represented by a formula

VS

1. Physical limits – biophysical, geophysical
2. Critical thresholds – Tipping points – State shifts
3. Declining marginal returns on added investments in complexity

Planetary Boundaries

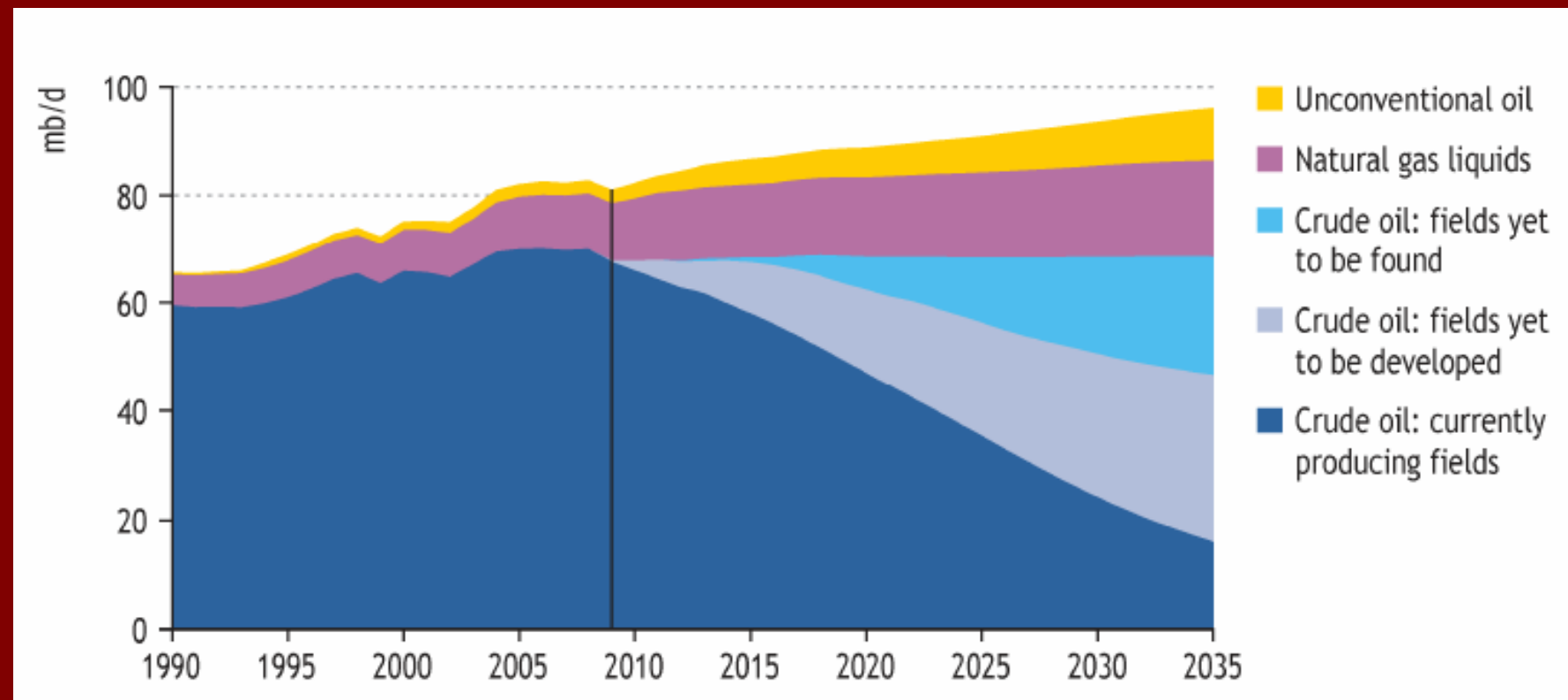
A safe operating space for humanity



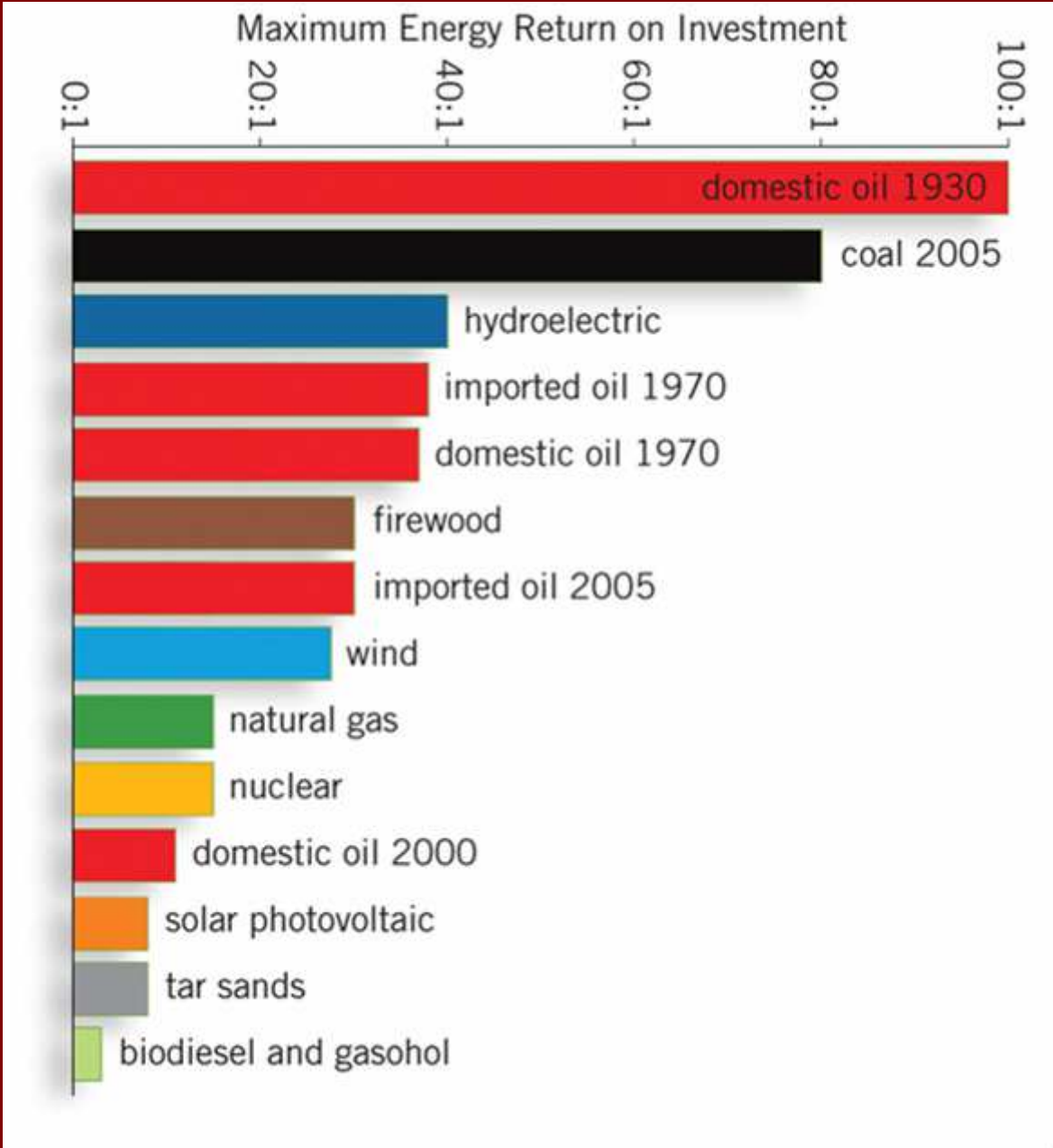
- Beyond zone of uncertainty (high risk)
- In zone of uncertainty (increasing risk)
- Below boundary (safe)
- Boundary not yet quantified

Source: Steffen et al. Planetary Boundaries: Guiding human development on a changing planet, Science, 16 January 2015.
Design: Globalia

Biophysical Limits: Oil Production



IEA World Energy Outlook 2010

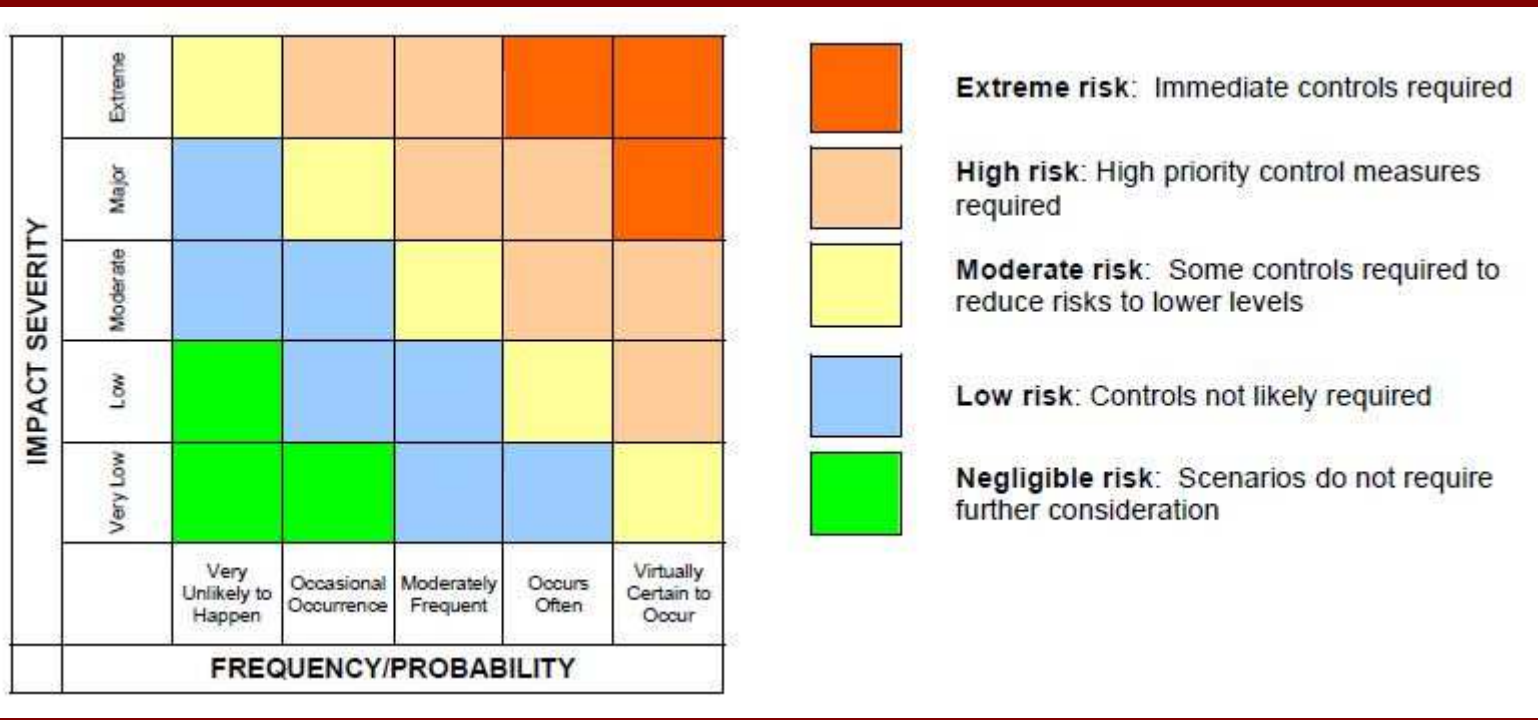


Critical Thresholds: Extreme Weather

- **Russia, 2010:** More than 300,000 acres burned, entire wheat crop destroyed
- **Thailand, 2011:** 65 of its 77 provinces declared flood disaster zones – over 20,000 sq km's of farmland damaged
- **US, March 2012:** 15,272 warm temperature records broken
- **Colorado, 2013:** One year's average rainfall dumped in 5 days
- **California drought, UK floods, 2014**
- **Burlington, ON, August 2014:** 2 month's rain in 2.5 hours

Another exponential curve: Debt

from Chris Martenson's 'Crash Course':
<https://youtu.be/GXHvaKA36YM>



IMPACT = POPULATION x CONSUMPTION / TIME

How to change a system with such scale and momentum as our current one?



How Wolves Change Rivers
<https://youtu.be/ysa5OBhXz-Q>



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It is not the strongest of the species that survives, nor the most intelligent that survives.
It is the one that is the most adaptable to change.

Charles Darwin