Anticipating interactions among converging biogeochemical forces and human society

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200 years of GDP growth have been driven by substituting cheap fossil fuels for human labor.
Energy available for GDP growth

Energy costs of exploration, extraction, transport, processing & distributing

Unavoidable waste heat

Adapted from Arnoux 2016
As EROEI declines, ever more energy is needed per unit of economic growth.

Replacing fossil fuel infrastructure (e.g., with renewables) requires energy.

The faster you try to build the replacement infrastructure, the less energy you have for growth.

Damned if you do... damned if you don’t.
HOUSEHOLD USE
We estimate that 808 trillion microbeads may be washed down household drains in the United States every day.

WASTEWATER TREATMENT
We estimate that 8 trillion microbeads may be released into waterways via final effluent every day\textsuperscript{9,12}

AQUATIC HABITATS
In aquatic habitats, microbeads absorb chemical pollutants\textsuperscript{6}, which can transfer to animals that ingest them\textsuperscript{7}, and cause cellular necrosis, inflammation and laceration of tissues\textsuperscript{5}.

At wastewater treatment plants, an estimated 99\% of microbeads settle into sludge\textsuperscript{9,11,12}

Sludge is often land-applied as fertilizer and the remaining 800 trillion microbeads may enter aquatic habitats via runoff.
Assembling a ‘network of brains’

Expert Advisory Council

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Martin Rees, Cambridge
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Assembling a ‘Network Of Brains’

William Rees  Carl Safina  Stefano Parmigiani
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Corey Goodman  Gus Speth  Richard Jackson
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Gerardo Ceballos  Thomas Lovejoy  Martin Scheringer
Jane Muncke  Diana Wall  David Montgomery
William Perry  Thomas Homer-Dixon  Ugo Bardi
Terrence Collins  Leslie Harroun
Des Browne  Irene Krarup  Some of >100 NOB members
Mideast Refugee Crisis
East China Sea fishery
Round Up impacts on soil fertility
Financial collapse?
The Fan Initiative steps

1: Build out the Network of Brains
2: Series of workshops on Cross-Blade Interactions
3: Condense results of workshops into planning documents; identify research needs
4: Globally regional planning workshops develop scenarios based on documents and identify near- and long-term steps to increase resilience and preparedness
5: Collate the regional workshop results in a global workshop
6: Develop and disseminate results to different audiences under guidance of communications professionals.