



The Little Things that Run the World*



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An Environmental Symposium on Pollinators

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*E.O. Wilson, 1987, Conservation Biology, Vol. 1, No. 4, pp. 344-346



Image by: Stockli, Nelson, Hasler
Laboratory for Atmospheres
Goddard Space Flight Center
<http://rsd.gsfc.nasa.gov/rsd>



Hurricane Linda west of Mexico
September 9, 1997 17:45 UTC
Data from: NASA, NOAA, USGS

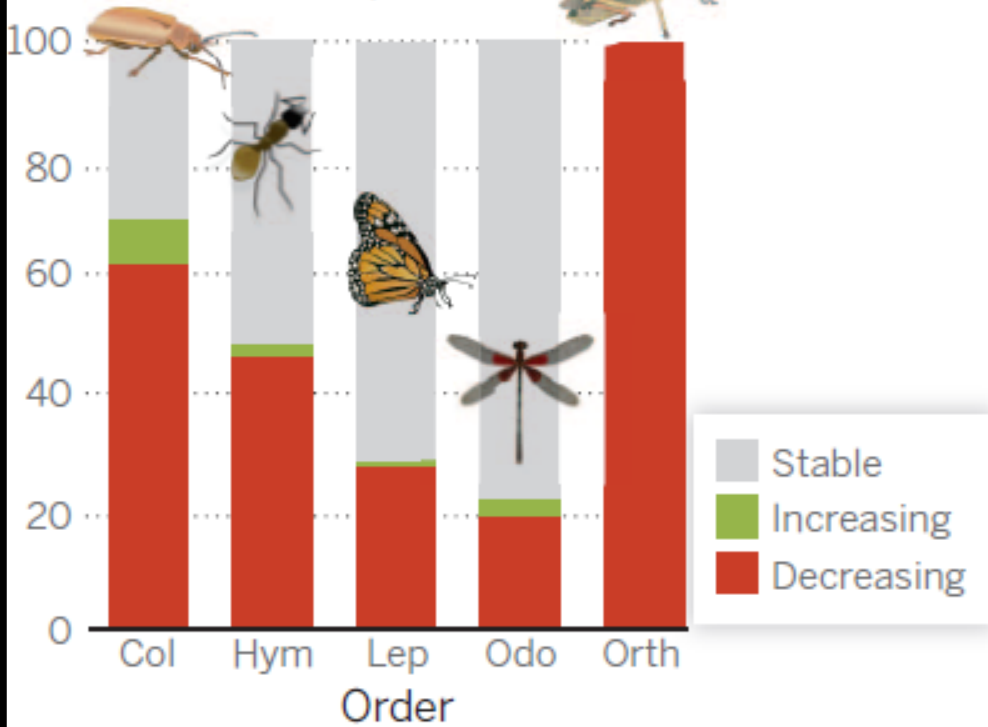


About 62 miles of atmosphere is all that protects us from space!

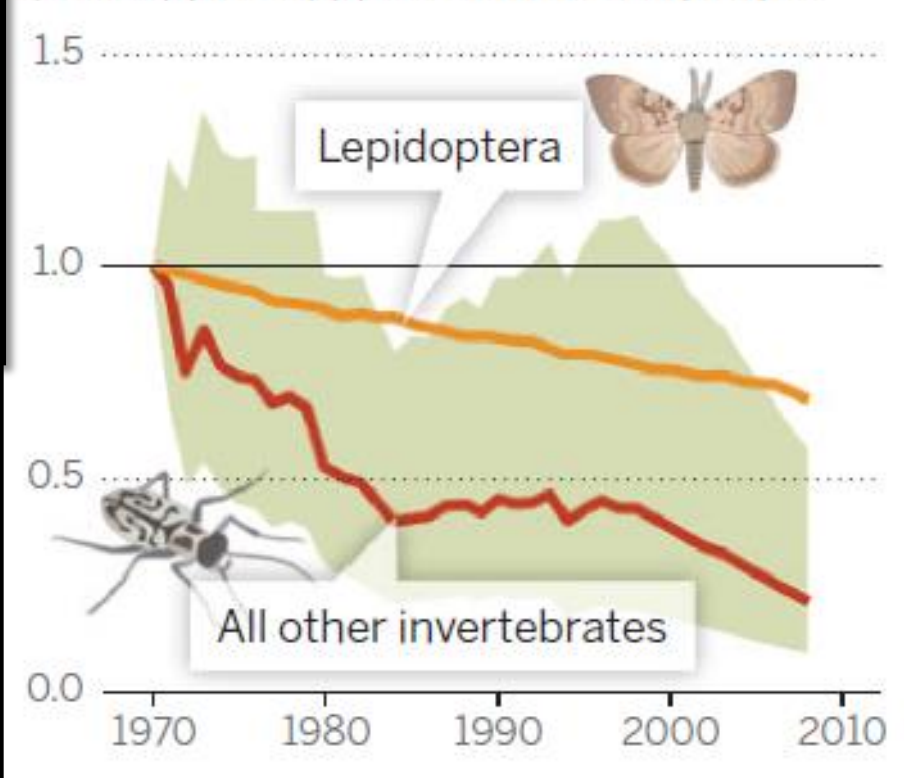
Current State of the World

- Bees and other pollinators: 87% decline
- Habitat loss, fragmentation and modification, loss of connectivity, agricultural and grazing practices, landscaping practices, pesticide use, and the introduction of nonnative species
- Intact ecosystems function!
- (<http://www.esa.org/ecoservices/poll/body.poll.scie.decl.html>)

Percent of insect species



Global index of invertebrate abundance



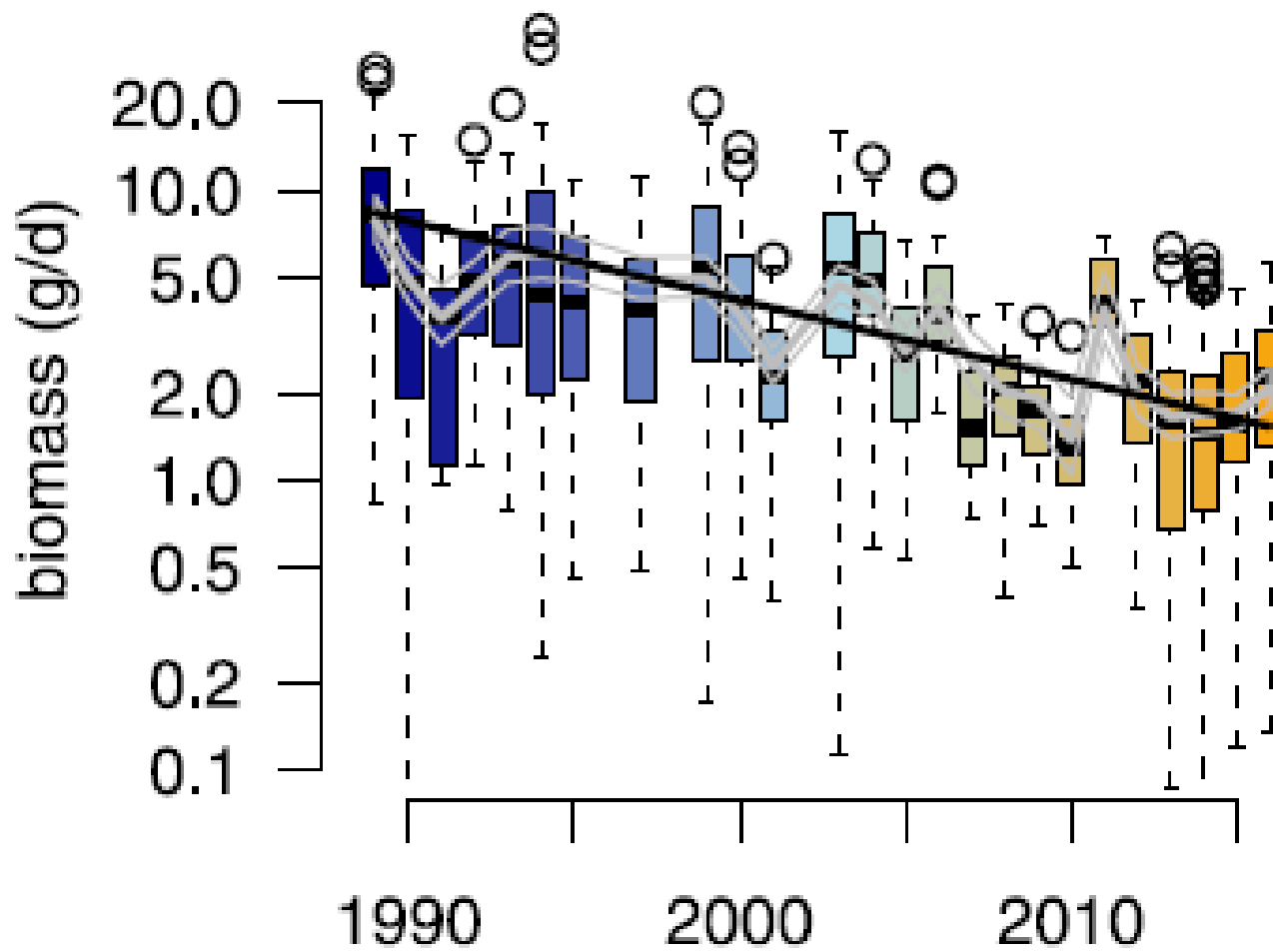
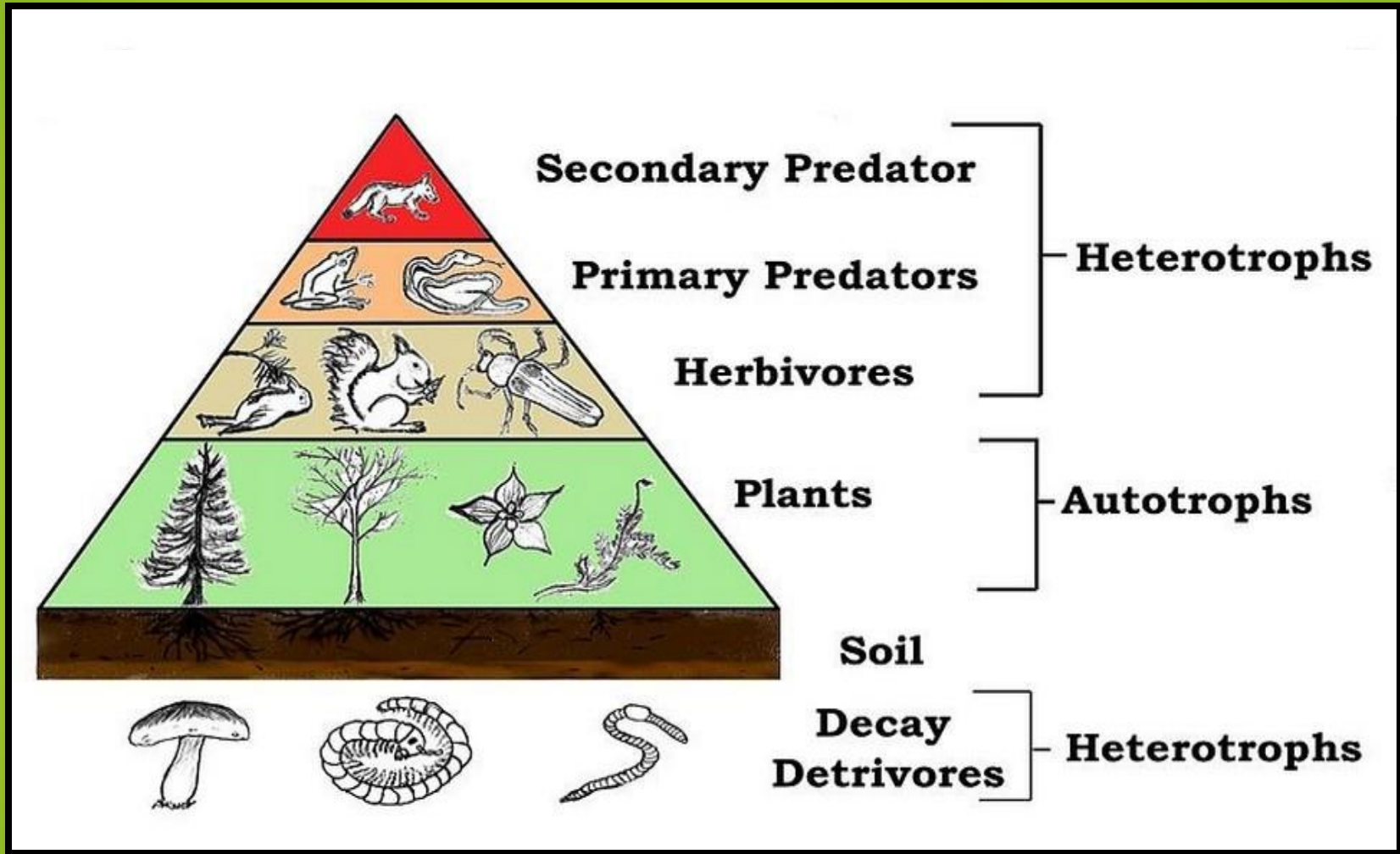


Fig 2. Temporal distribution of insect biomass. Boxplots depict the distribution of insect biomass (gram per day) pooled over all traps and catches in each year ($n = 1503$). Based on our final model, the grey line depicts the fitted mean (+95% posterior credible intervals) taking into account weather, landscape and habitat effects.

Current State of the World

- Insects evolved 400 million years ago
- Millions of insect species constitutes ~50% of all life on Earth!
- Loss of insect diversity and abundance
 - Leads to a cascading effect on food webs
 - Decreases ecosystem function
 - Jeopardizes ecosystem services



Insect Ecosystem Services

- **The economic value of ecosystem services *provided by insects* is more than \$57 billion dollars per year** (Losey & Vaughan 2006)(~\$70 billion in 2017)
 - Soil and water nutrient recycling
 - Soil and water improvement (fertilization, aeration, cycling of nutrients and managing wastes)
 - Ground-dwelling invertebrates produce more than \$25 billion worth of topsoil globally per year (2002)
 - Food resources for other wildlife
 - Waste management
 - But the above value does not include dead animal and plant decomposition (not enough quantitative data)

Insect Ecosystem Services

- **Insects act as pest control**
 - \$50 million of beneficial insects sold worldwide to control pest insects (Vaughan 2002)
- **Insects are recreation boosters!**
 - Bird, reptile, amphibian, dragonfly, and butterfly watching
 - Most species being “watched” by enthusiasts rely on insects at some life stage for food, and/or *are insects!*



Insect Ecosystem Services

- **Insects provide pollination of both human and animal crops**
 - \$18-27 billion is the value of insect pollination (Xerces 2003)
 - Beetles, flies, wasps, butterflies, moths, ants, and bees pollinate



Invertebrate Services Value: Priceless

- Human lives depend on functioning and intact ecosystems, in which invertebrates play a vital role
- **“Preservation of whole habitats is urgently needed...to avoid cascading effects of species (co-) extinctions.”** (Koh et al. 2004)
- With isolated populations, there are often no source populations for re-colonization once a colony has been extirpated (Hatfield et al 2015)

SE Florida's Natural Communities

- 47 unique habitats in South Florida, including:
 - Pine Rockland
 - Rockland Hammock
 - Beach Dune
 - Maritime Hammock
 - Marl Prairie
 - Slough or Glades Marsh
- Each depends on insects to function!

Pine Rockland Habitat

- More than 534 endemic species of rare and endangered plants
- More than 50 species of butterflies, including federally endangered taxa
- Hundreds of moth species
- Extremely rare insects, such as Miami Tiger Beetle





Honey bee. Source: Janson Jones



Source: Michael Richardson



Honey Bee Pollination

- Spanish Needles
- Pineland Allamanda
- Thistle
- Beautyberry
- Locustberry
- Silver palm
- Firebush
- MANY others



Common Long-horned Bee

- Marlberry
- Vernonia



Source: Will Stuart

Sweat bee

- Marlberry



Source: SE Orell



Oil-gathering bee

- Locustberry
- Clusia



Source: Tim Lethbridge

Carpenter bee

- Spurred butterfly pea
- Passionvine



Source: Rispeer

Bumblebee

- Spurred butterfly pea



Source: JC Jones

Ground-nesting bee

- Spurred butterfly pea



Solitary Bee

- Man-in-the-ground



How to Help

- Go organic! Buy NON-GMO!
- Compost kitchen and yard waste
 - Makes the best compost & best fertilizer for your garden!
 - Invest in a chipper for yard waste if needed
 - Grow your own veggies and fruits!

How to Help

- **But leave the leaves!**
 - Immature life stages of some butterflies, moths, beetles, fireflies and other insects *live in the leaf litter!*
 - These insects help keep the soil healthy
 - Organic matter for soil fertility
 - Earthworms, millipedes, sowbugs, earwigs and other invertebrates aerate and fertilize the soil
- Avoid using mulch from pine bark, cedar and cypress—it promotes *deforestation*
 - Thick wood mulches harbor fungus/molds

How to Help

- Install nest boxes for native birds, bats and solitary bees
- Leave “weedy” patches of native flowers
 - Choose to leave at least a corner grow tall with native grass to provide seeds for migrating birds
 - Build a brush pile for invertebrate life
- Spiders, reptiles, amphibians, rodents, and 96% of all terrestrial birds depend on insects for food
- Use appropriate cover on windows to reduce bird strike (National Audubon Society)

How to Help

Promote beneficial insects in your yard by providing native vegetation and mini-habitat



How to Help

- Visit Natives for Your Neighborhood!



- Join NatureScape Broward! Get certified!



- Use Florida Friendly Landscaping!





Garden Messy: Pledge to be a Lazy Gardener

Nature Conservancy/Cornell Lab of Ornithology



At the end of summer, bumble bee queens burrow just below the soil to wait out winter. Give them the extra protection they need.

LEAVE THE LEAVES



xerces.org

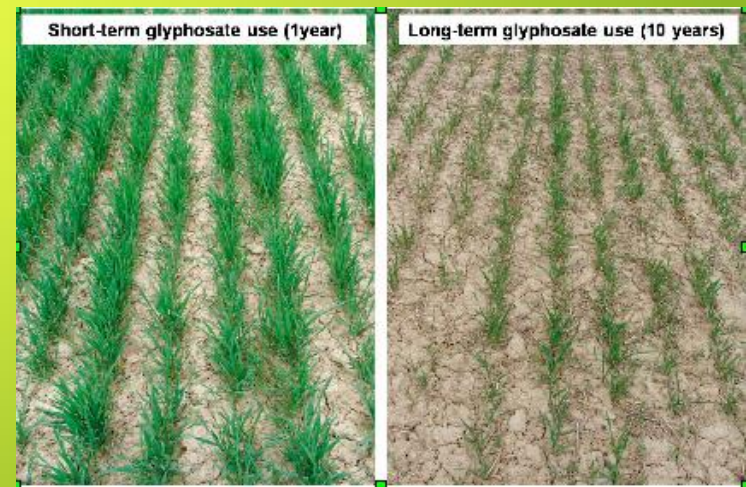
Photo by The Xerces Society / Sarah Foltz Jordan

How to Help

- Reduce pesticide use (herbicides, fertilizers, etc.)
 - 664 pounds of pesticide per 2.5 acres is used in Florida annually (Pimentel 2006)
 - Does not include mosquito control, or home pesticide use
 - A Washington Puget Sound study found *more pounds of pesticides per acre in urban neighborhoods* than in agricultural fields (do you really need a perfect lawn?)
- Contact Broward County Mosquito Control to request a no spray zone around your property
 - Reduce mosquito habitat!
 - Remove non-native water-holding plants and objects

How to Help

- Avoid Round-up! WHO determined glyphosate is carcinogenic (2015); banned in many other countries
 - Bermuda, Colombia, Guatemala, France, Germany
 - Argentine physicians call for ban
 - Brazilian federal prosecutor calls for ban
 - <http://web.mit.edu/demoscience/Monsanto/about.html>
 - http://www.naturalnews.com/031138_Monsanto_Roundup.html
- Toxins accumulate over time:



How to Help

- Avoid neonicotinoid pesticides!
 - These chemicals also persist on commercial plants for months
 - Buy native plants from local nurseries
- **Check garden products for, and avoid using, imidacloprid, dinotefuran, clothianidin, and thiamethoxam (all neonicotinoids)**



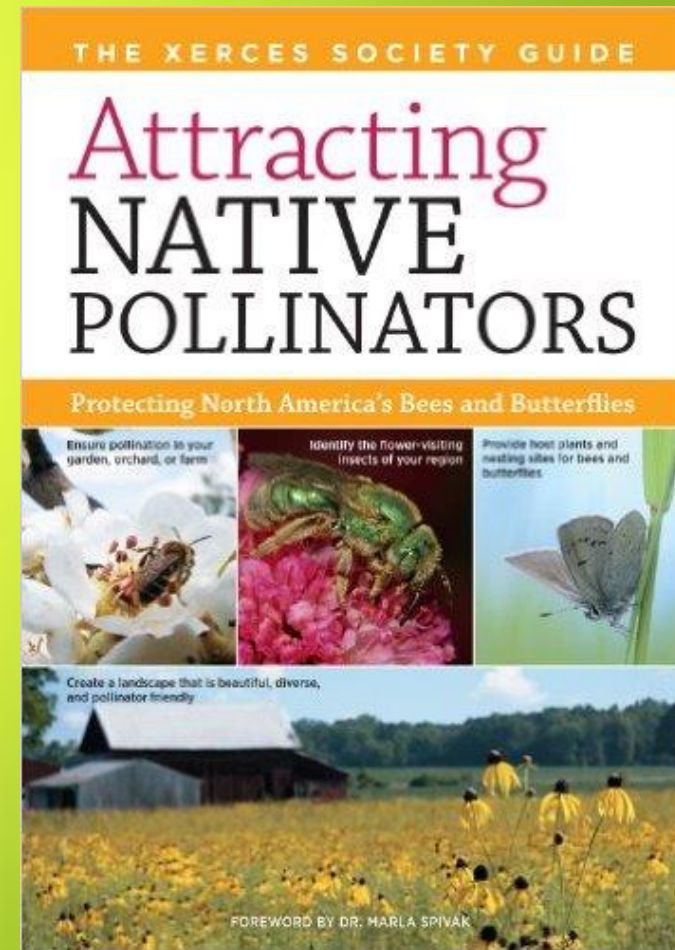
All but one of these garden insecticides contain neonicotinoids, and none of the labels indicate that they are poisonous to bees and adult butterflies. Photograph by Matthew Shepherd.

How to Help

- Join and support wildlife and conservation organizations
- Support local organic farms & nurseries
- Write letters to state, county, and city commissioners, and representatives
 - Refer to specific legislations, support for a specific bill, etc.
 - Explain how the issue affects you and your family
 - Remind them that you vote!

How to Help

- Buy “Attracting Native Pollinators” by the Xerces Society and encourage your neighbors to do the same!



How to Help

- Download a free PDF copy of “Habitat Planning for Beneficial Insects” by the Xerces Society!



How to Help

- *Half-Earth* states that the situation facing us is too large to be solved piecemeal and proposes a solution commensurate with the magnitude of the problem: dedicate fully half the surface of the Earth to nature.



half the earth for the rest of life

HALF-EARTH



*Our Planet's
Fight for Life*

EDWARD O. WILSON

WINNER OF THE PULITZER PRIZE

THANK YOU!
Questions?



The Gulf of Mexico (Source: NASA)