



# Wind Energy Development & Wildlife – Striving for Co-existence



Caroline Jezierski  
Nebraska Wind Energy & Wildlife  
Project Coordinator

ISU – October 26, 2012





### Sandwich Tern Sinks Big UK Offshore Wind Farm

tweet 1 Submit +1 0 0 Digg Like 1 by Pete Danko

## Wind turbines planned for northwest Illinois generate controversy

Potential effects on 3 threatened species among the concerns

## Wind farm proposed near bald eagle habitats to be delayed

ARTICLE COMMENTS

Home » News » Roads are detrimental to Europe's protected bats, new study finds  
**Roads are detrimental to Europe's protected bats, new study finds**  
Published on 2 November 2011

## Lawsuit says wind energy industry hurts condors

Associated Press  
Posted: 04/22/2012 06:55:27 PM PDT  
Updated: 04/22/2012 10:22:38 PM PDT

## Bird Deaths Haunt Wind Energy Interior Dept. puts forth plan

Ken Silverstein | Apr 02, 2012 Share / S

TUESDAY, JUNE 19, 2012

## BLM Rejects Wind Energy Project Application

## Bend Group Sues to Halt Steens Mtn. Wind Project ONDA Leader Calls it 'Right Idea in Wrong Place'

By Matt  
POSTED: 12:20 AM PDT April 5, 2012  
UPDATED: 6:25 AM PDT April 5, 2012 Print Email

## Commercial wind turbines are killing endangered bats

Two species, northern myotis and little brown myotis, account for 40 per cent of such deaths at one site in northeastern B.C

BY LARRY PYNN, VANCOUVER SUN JUNE 12, 2012

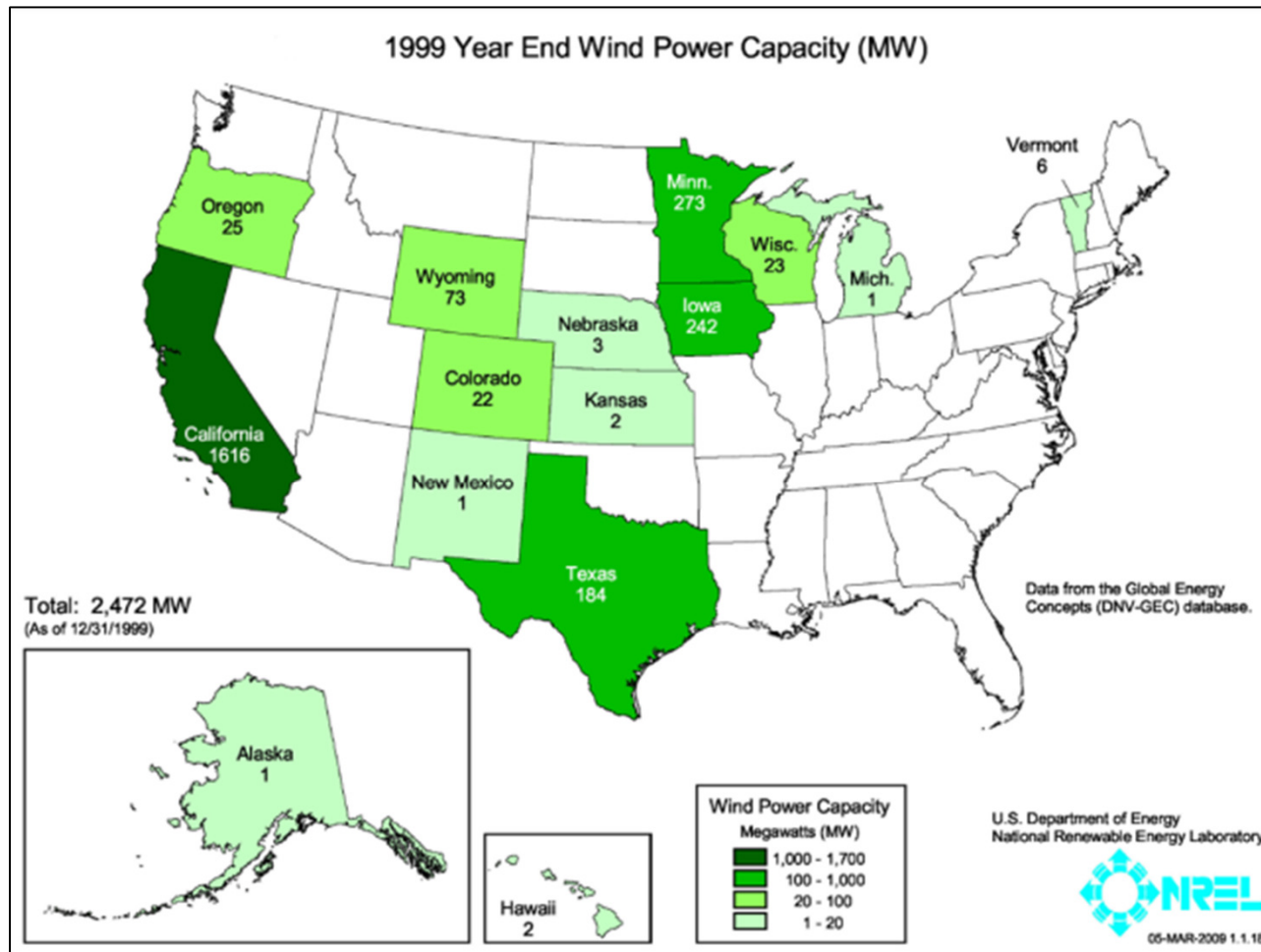
### Science News

... from universities, journals, and other research organizations

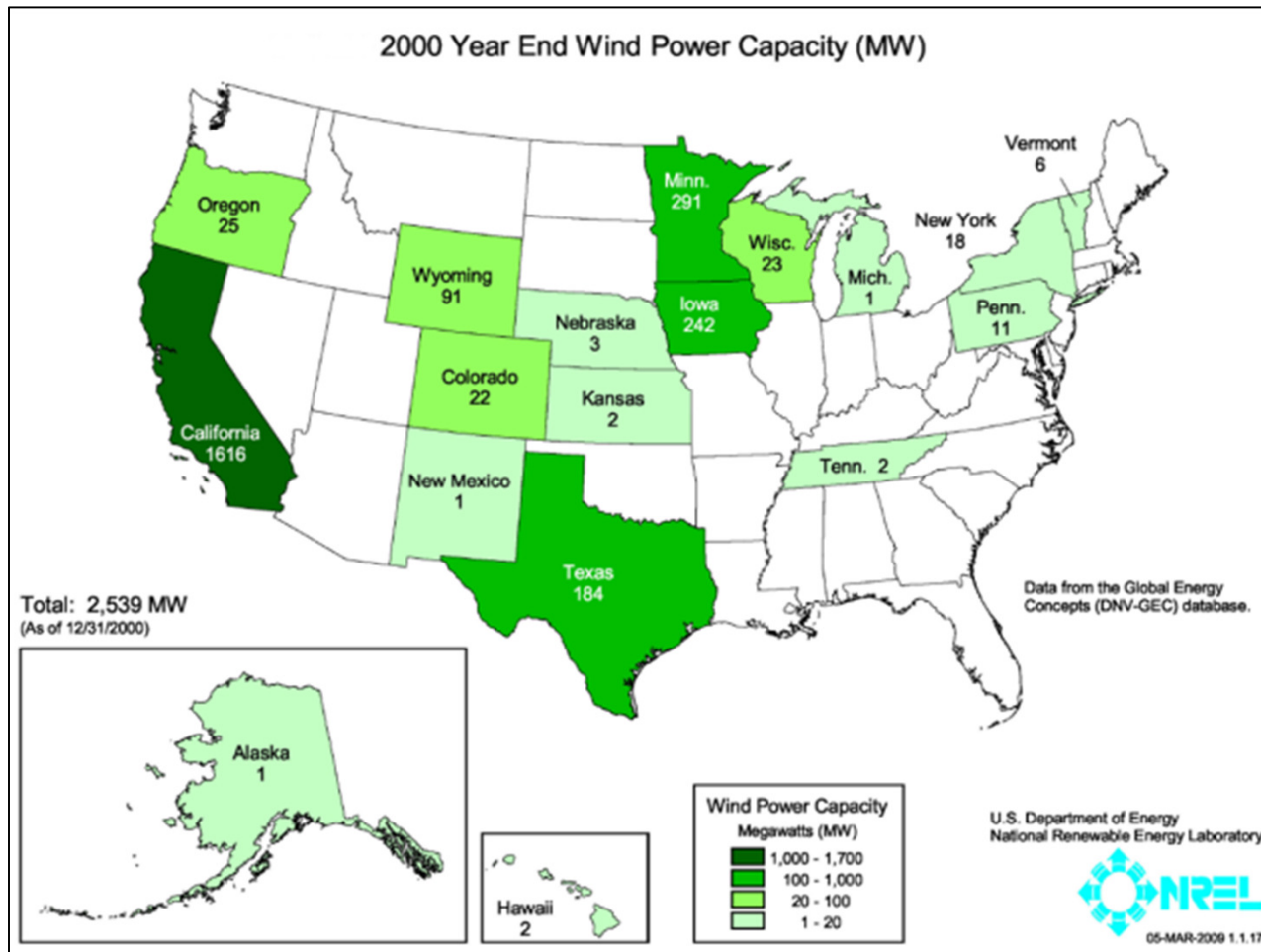
## German Wind Farms Can Kill Bats from Near and Far, Research Suggests

ScienceDaily (July 2, 2012) — Wind turbines may

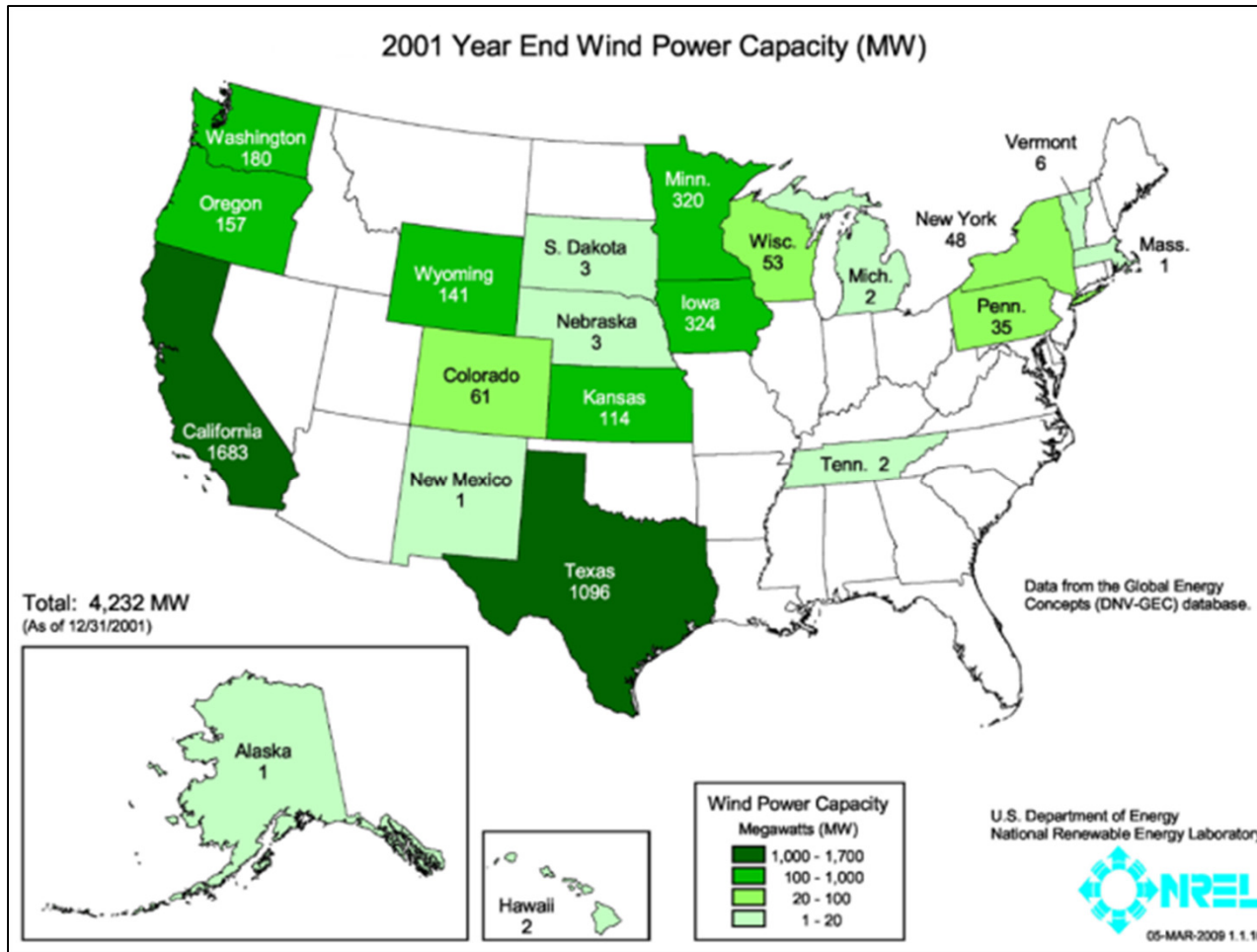
# Installed Wind Power Capacity



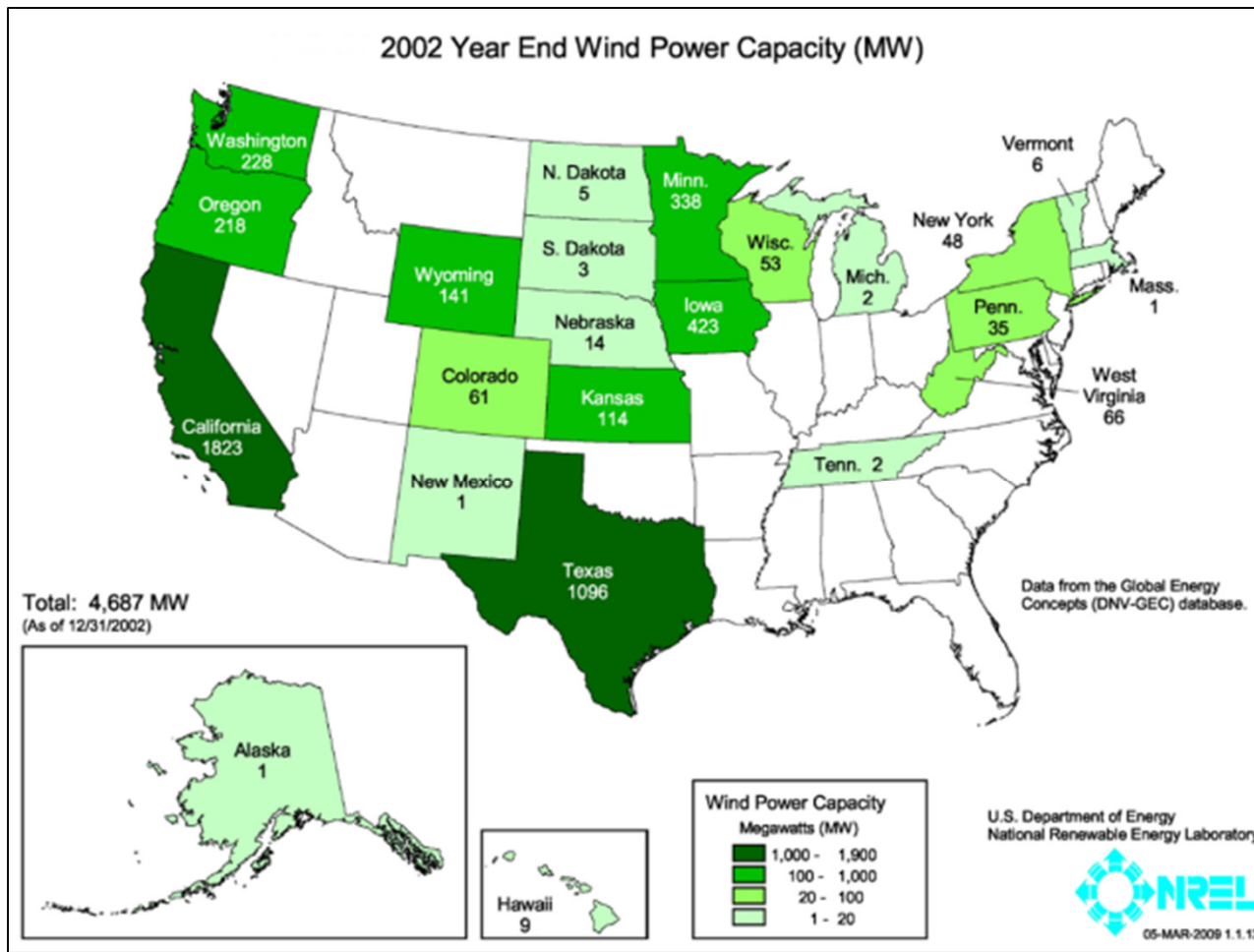
# Installed Wind Power Capacity



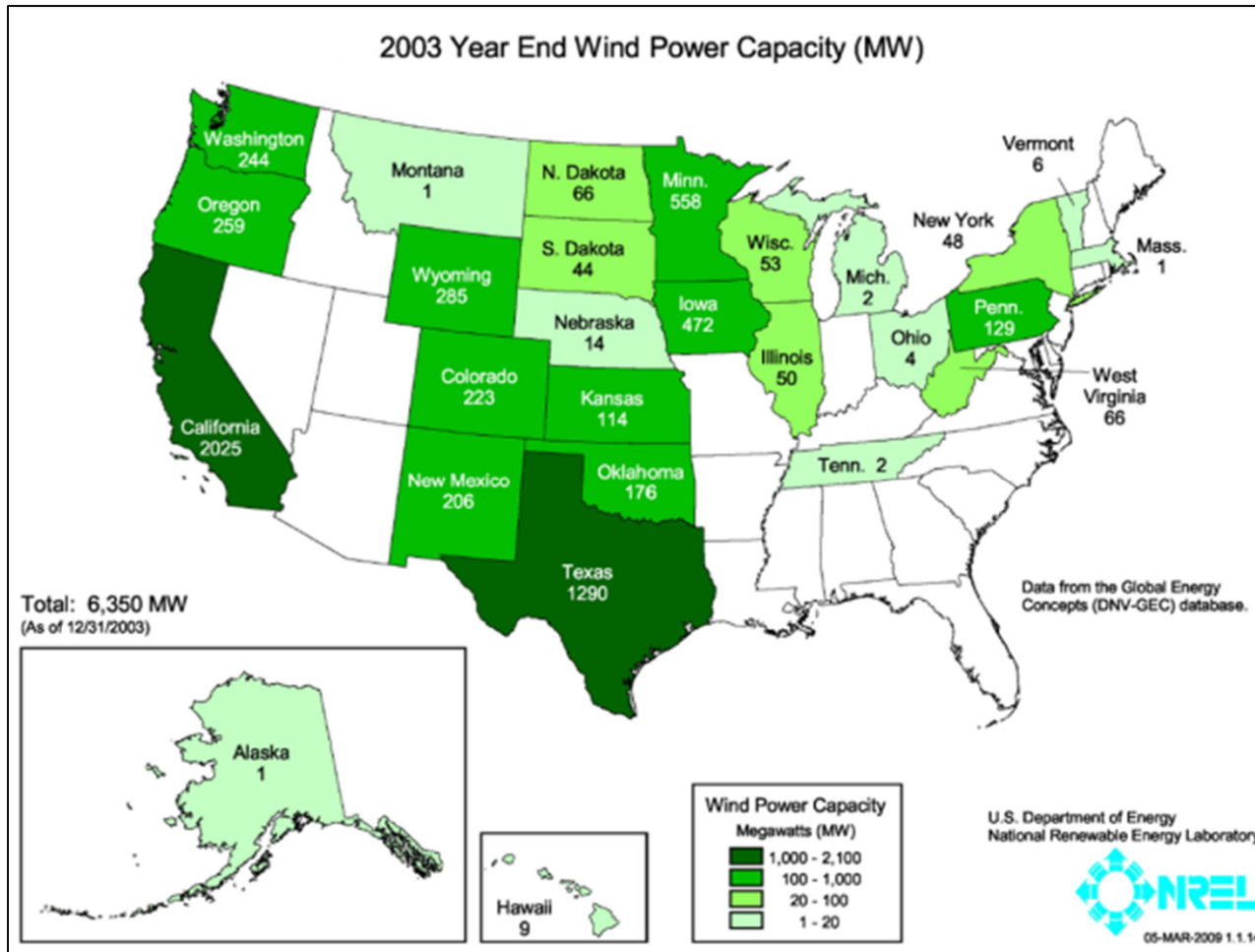
# Installed Wind Power Capacity



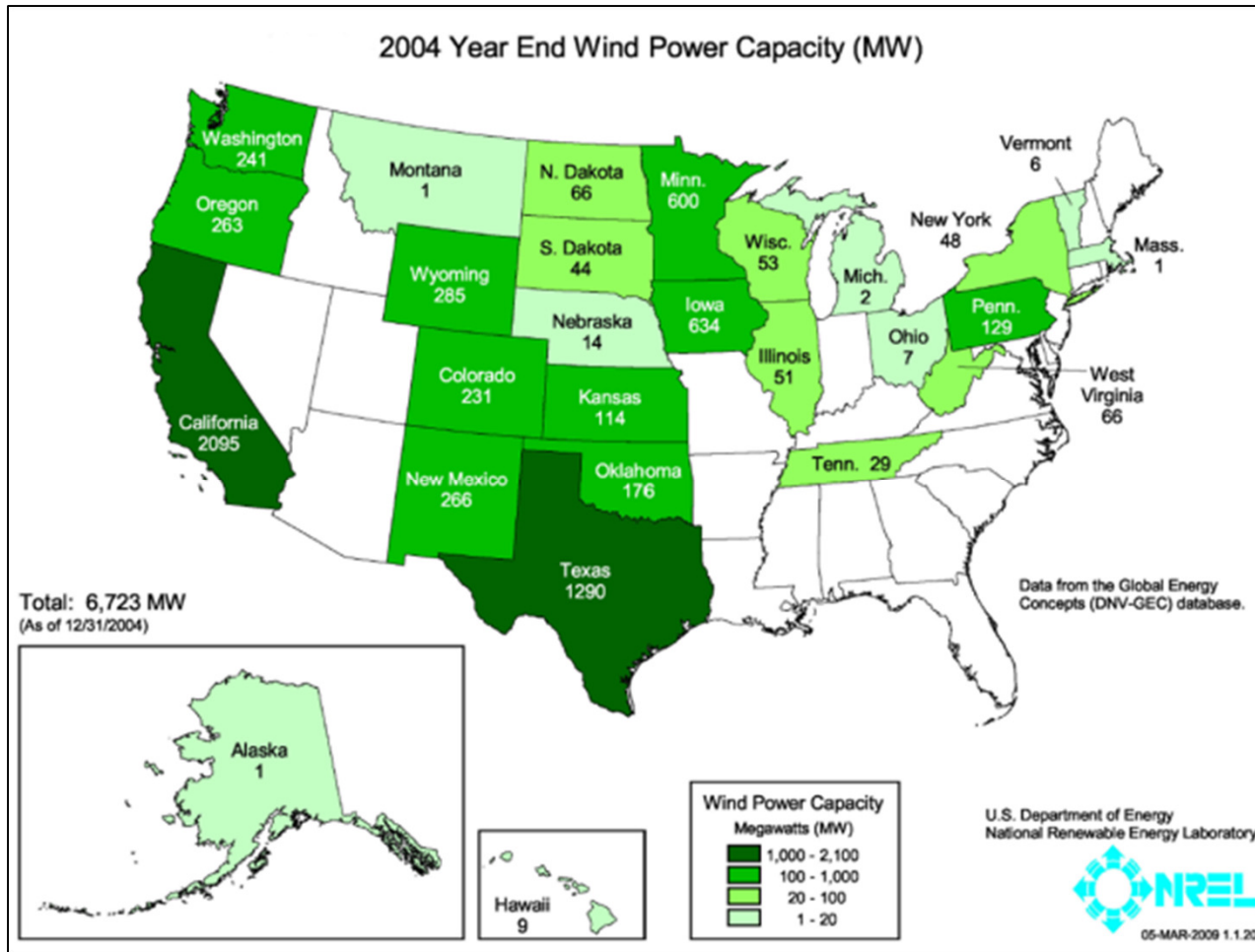
# Installed Wind Power Capacity



# Installed Wind Power Capacity

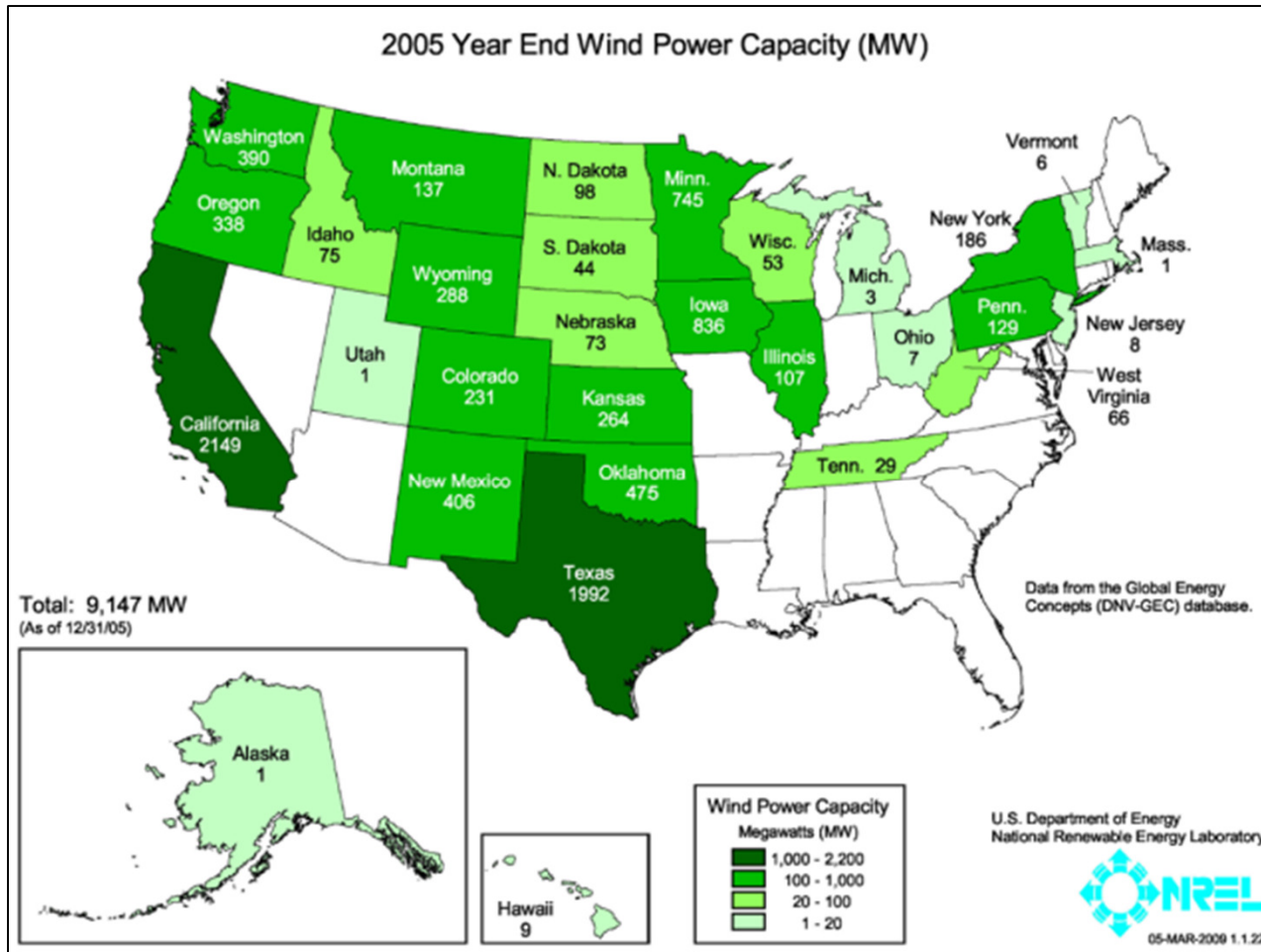


# Installed Wind Power Capacity

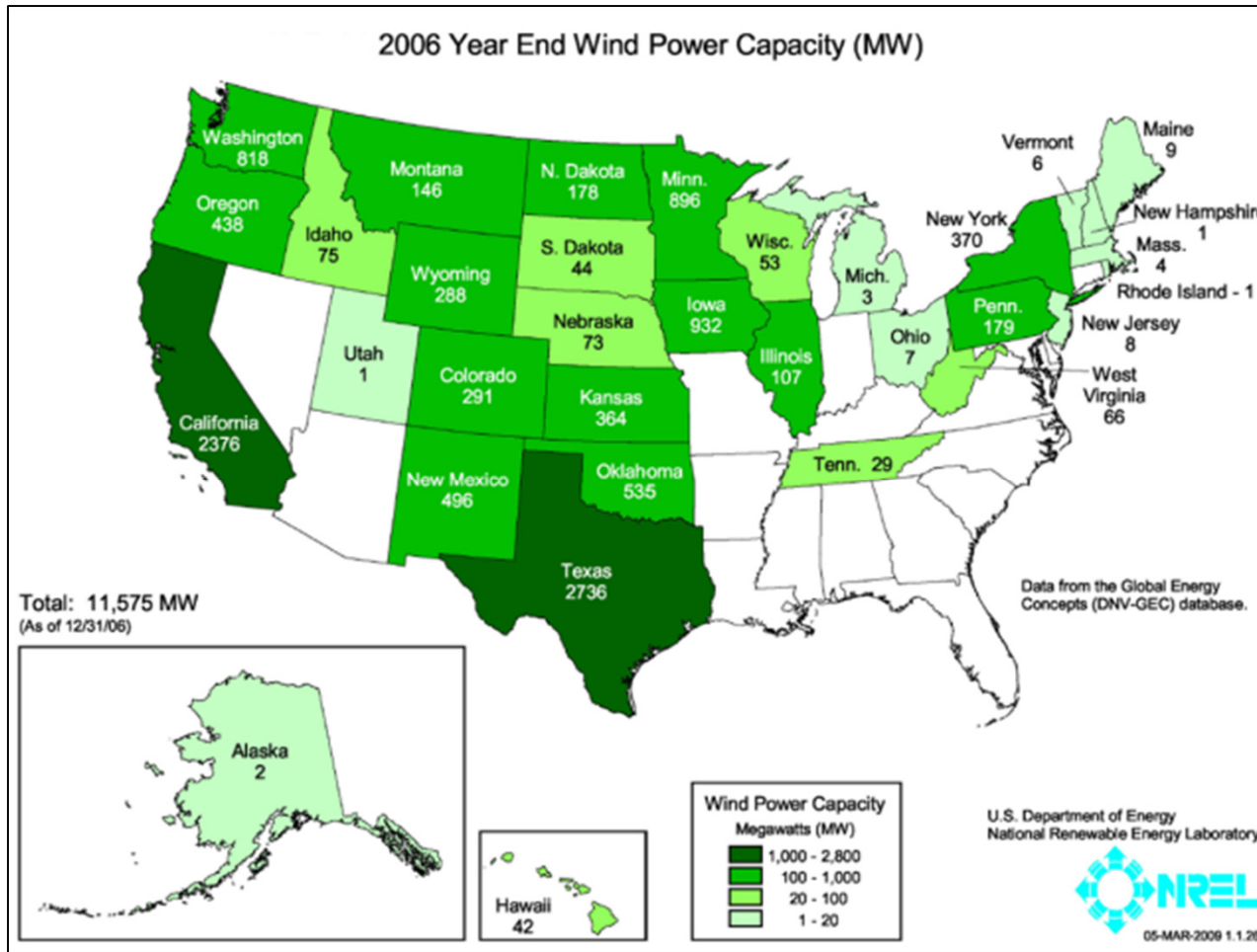




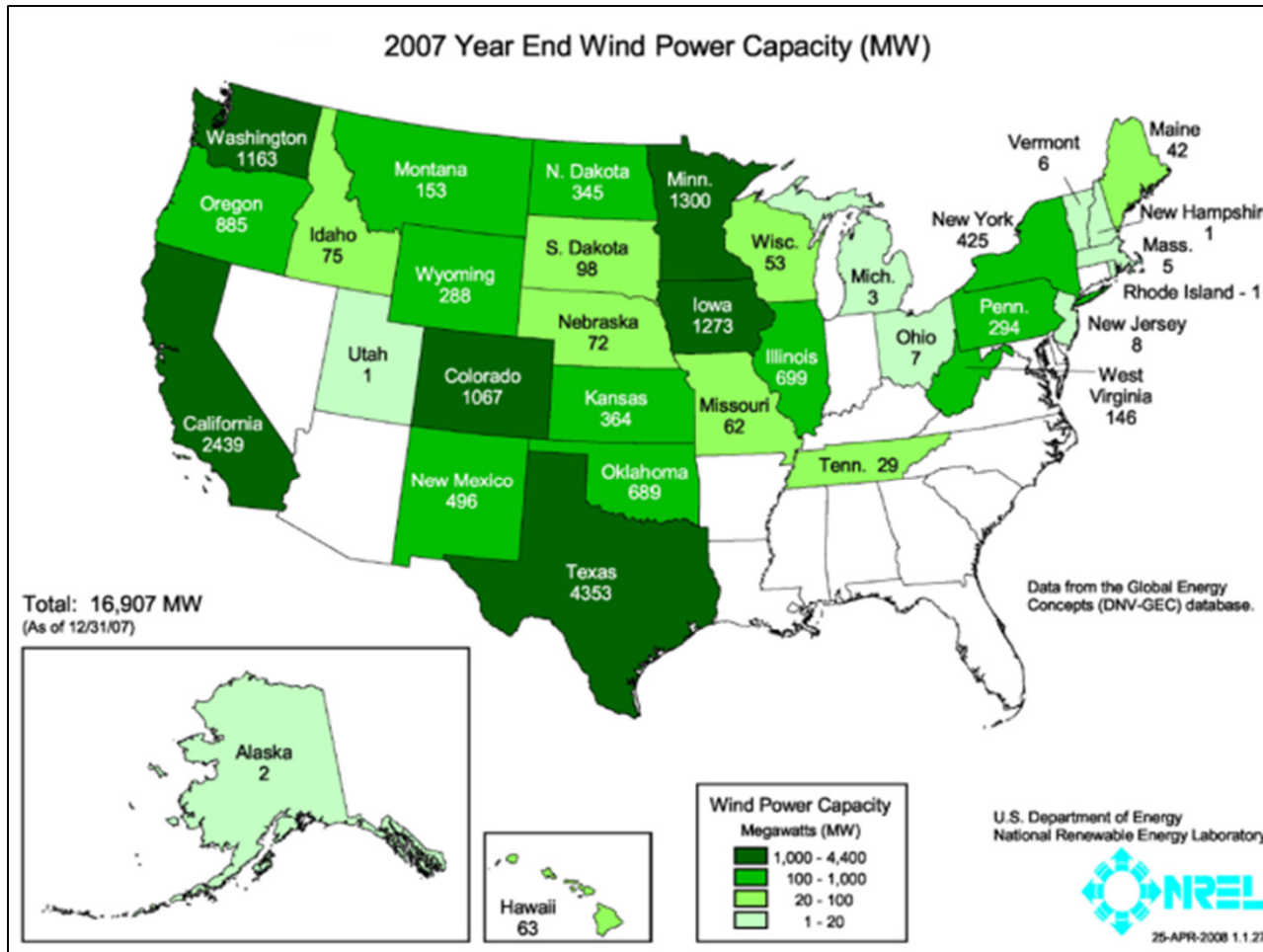
# Installed Wind Power Capacity



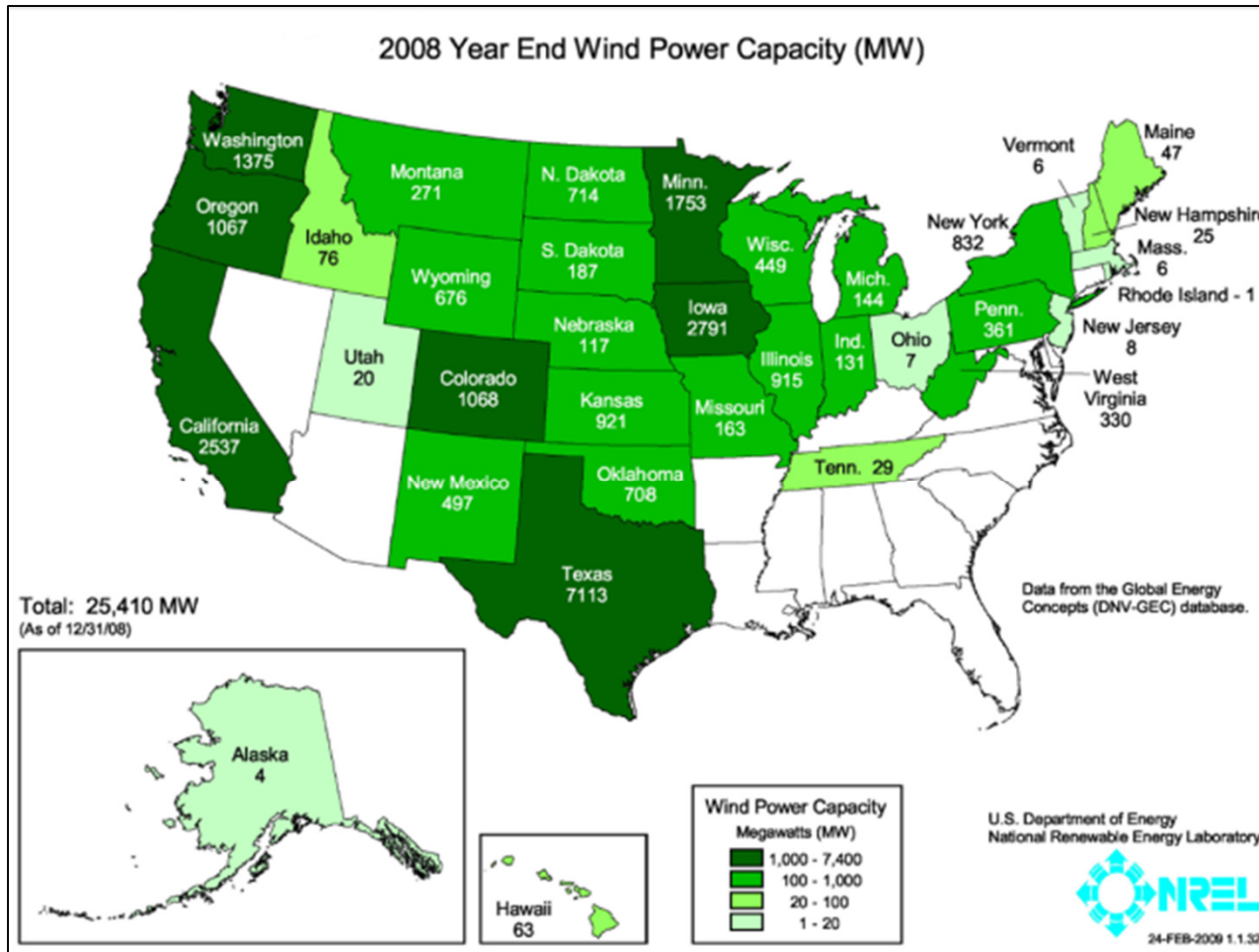
# Installed Wind Power Capacity



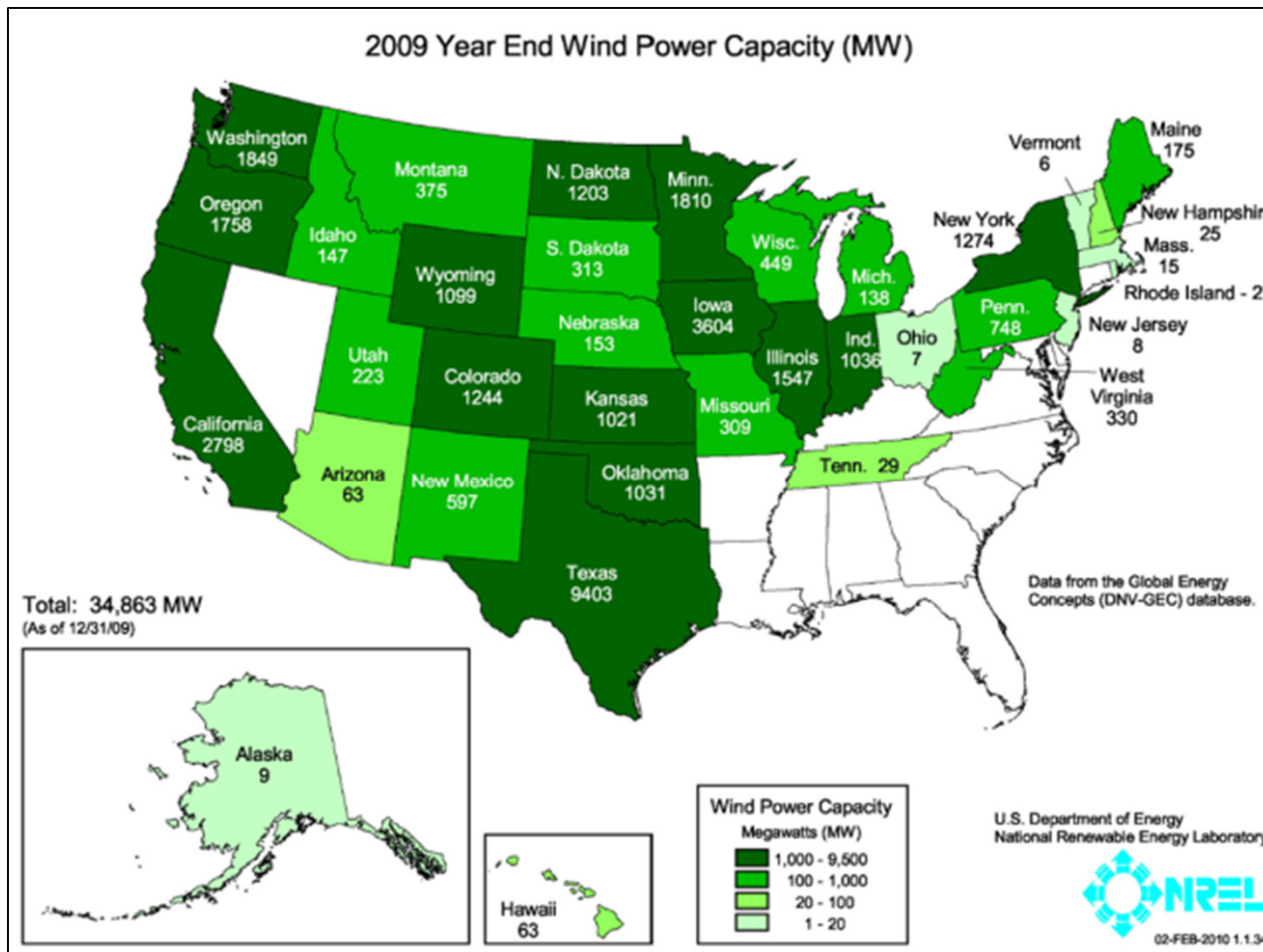
# Installed Wind Power Capacity



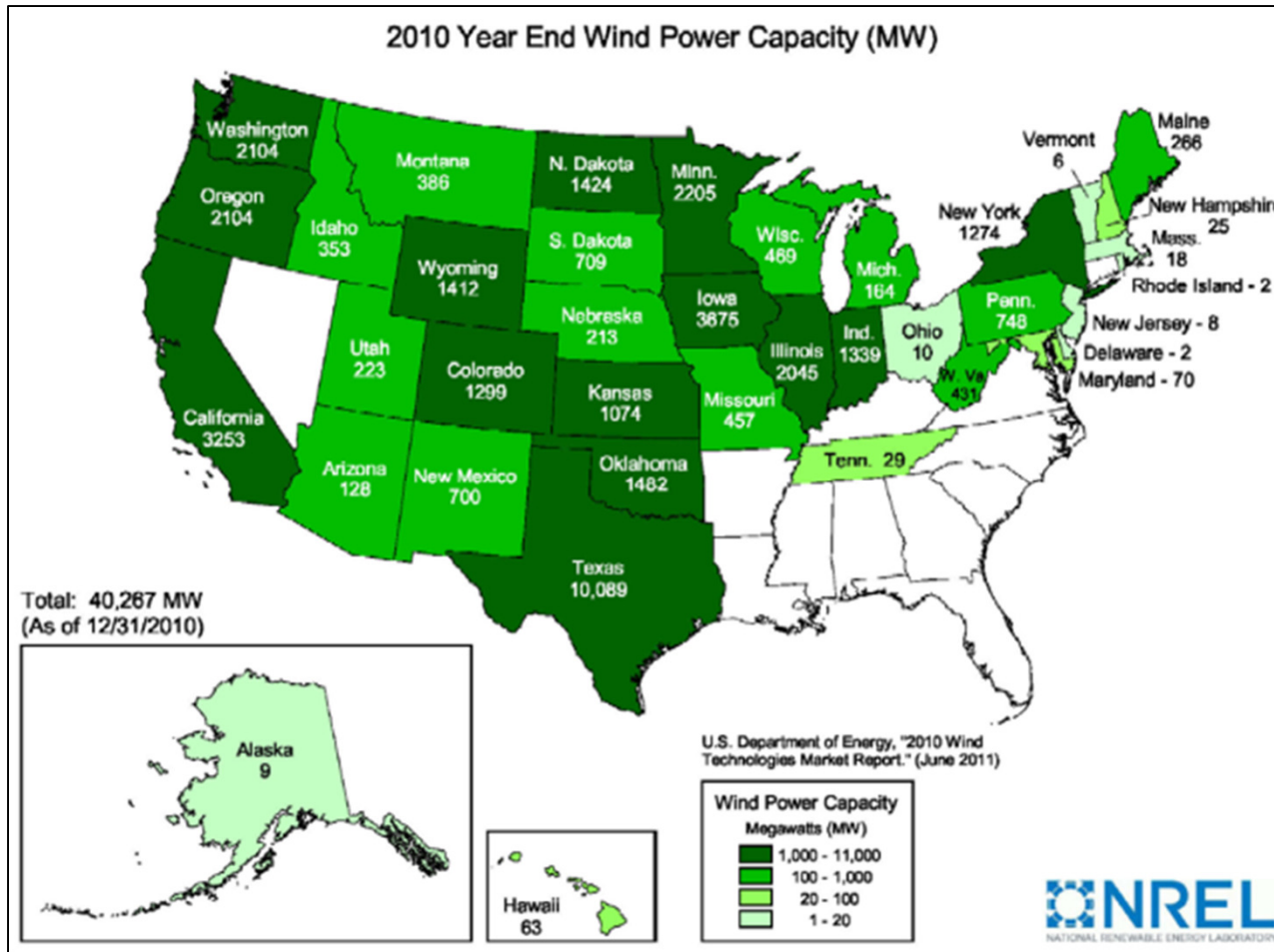
# Installed Wind Power Capacity



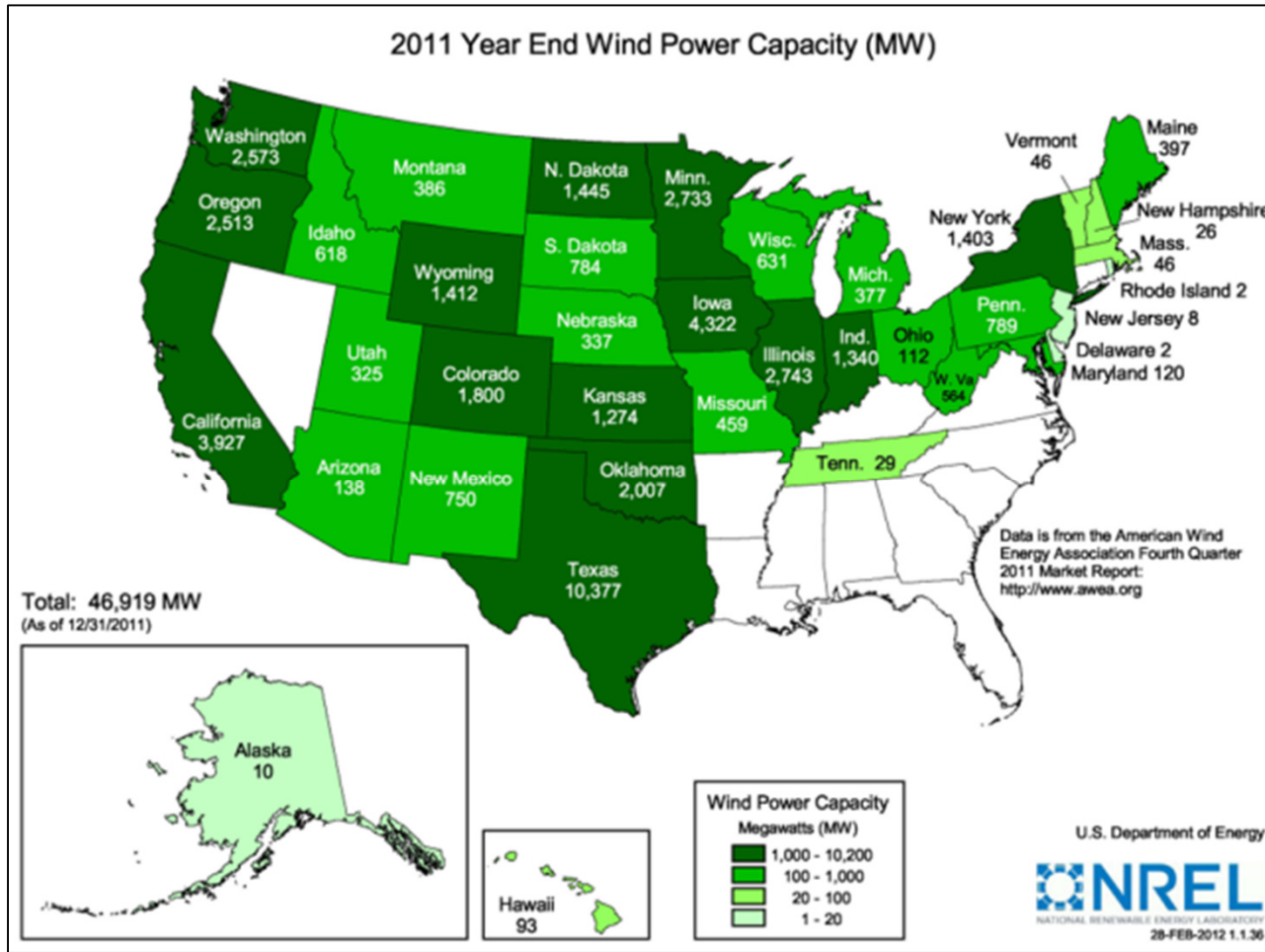
# Installed Wind Power Capacity



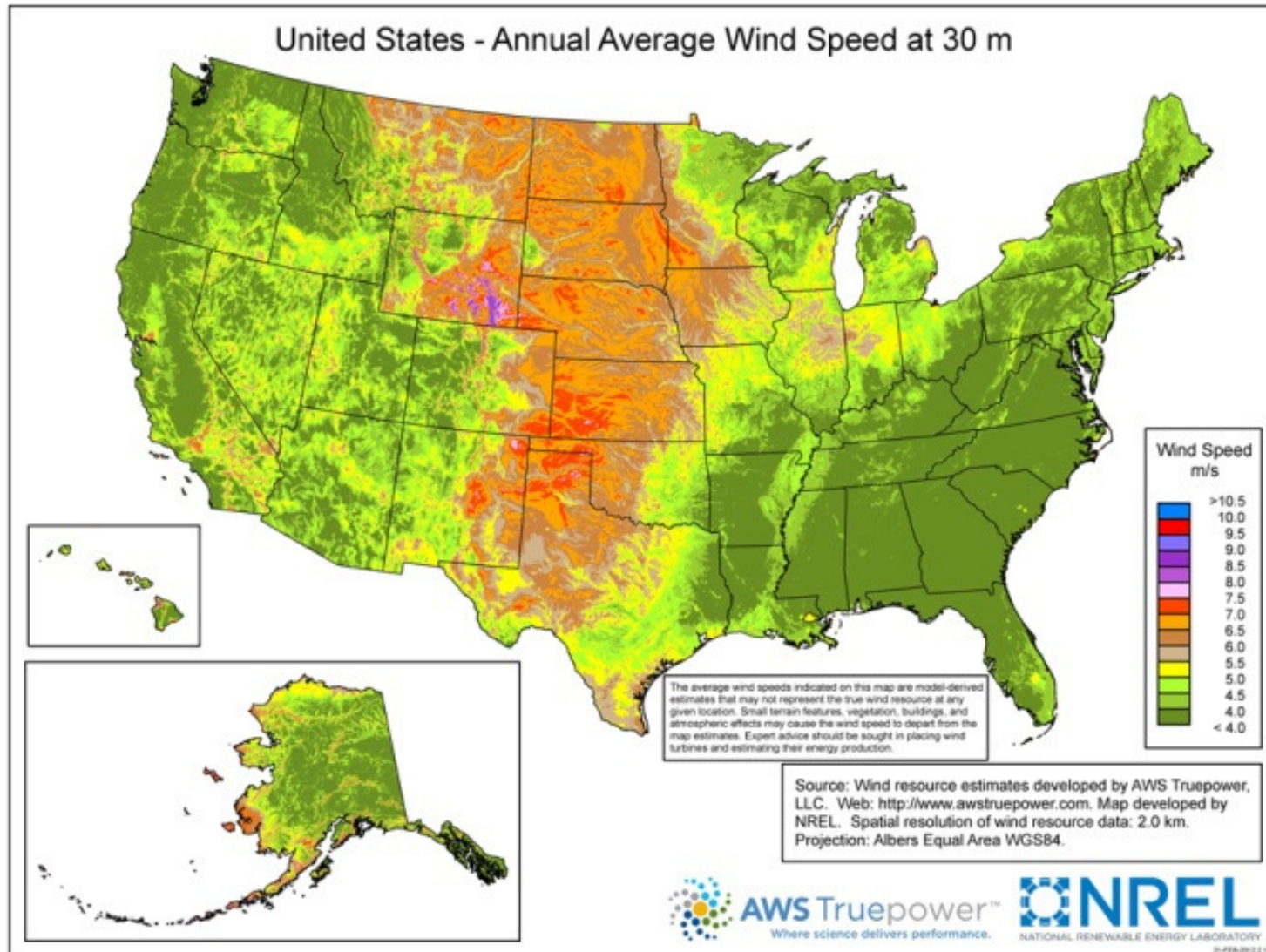
# Installed Wind Power Capacity



# Installed Wind Power Capacity



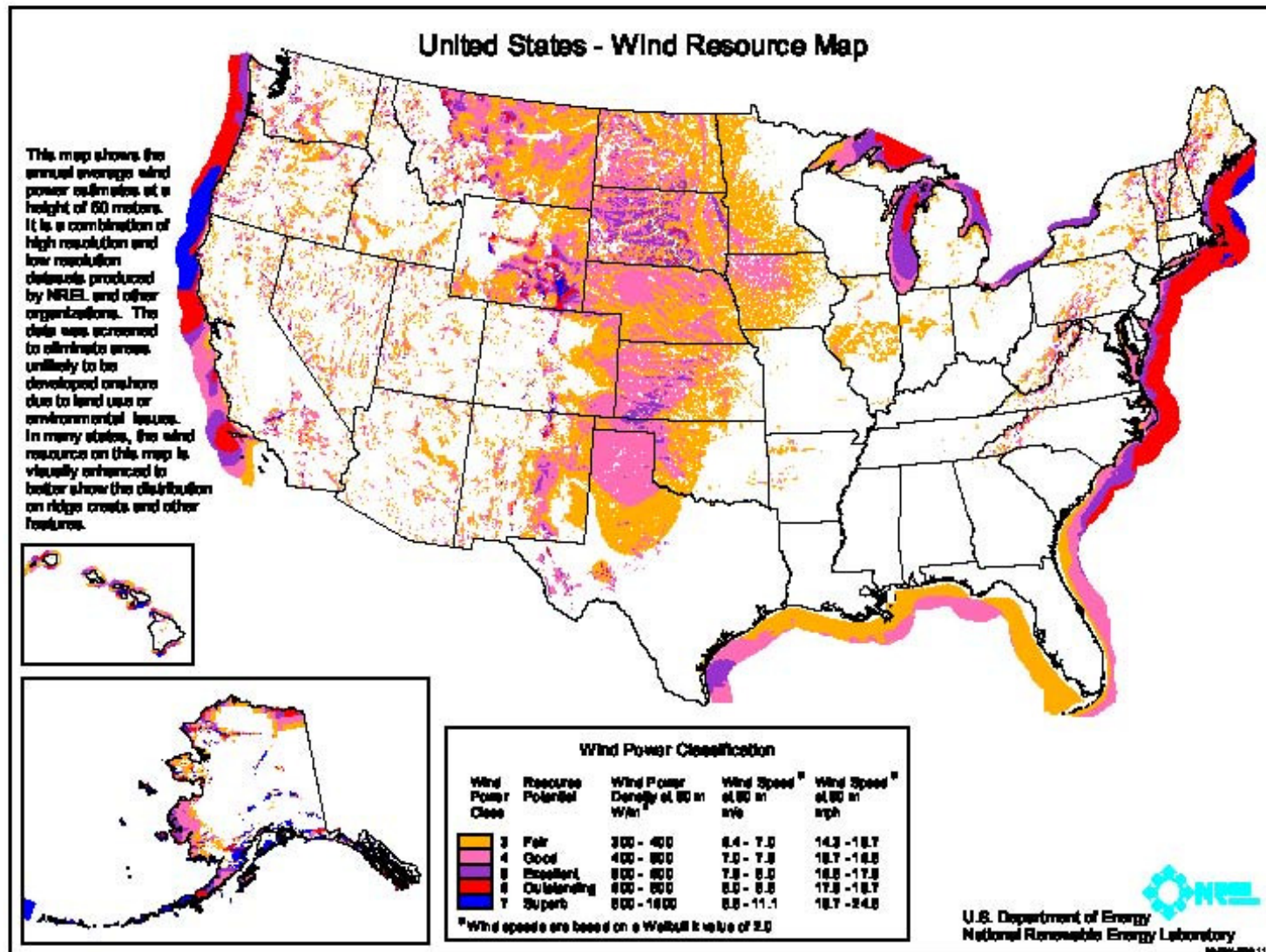
# Wind Energy Potential @ 30m



[http://www.nrel.gov/gis/images/30m\\_US\\_Wind.jpg](http://www.nrel.gov/gis/images/30m_US_Wind.jpg)



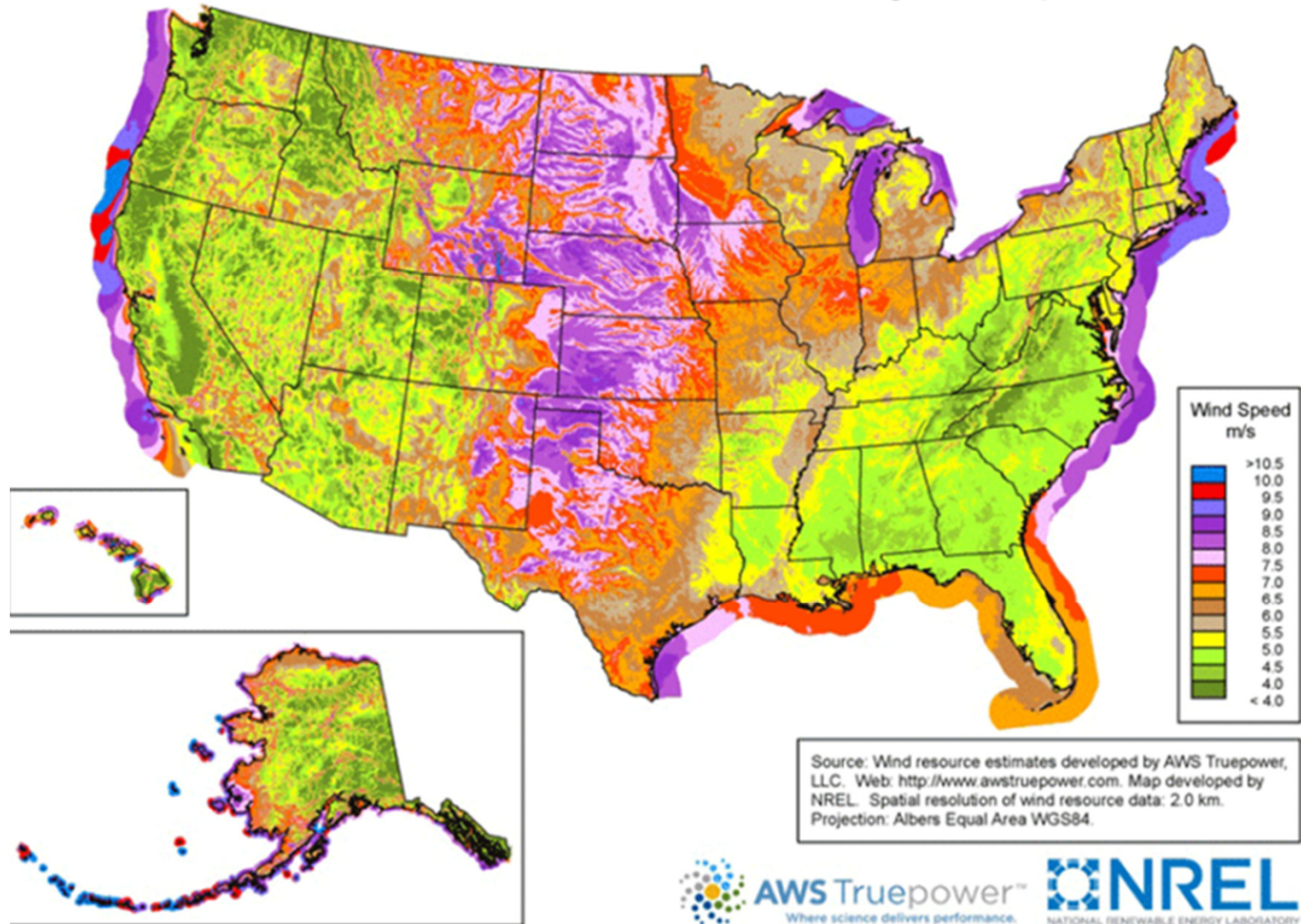
# Wind Energy Potential @ 50m



<http://www.nrel.gov/gis/images/US-50m-wind-power-map.jpg>

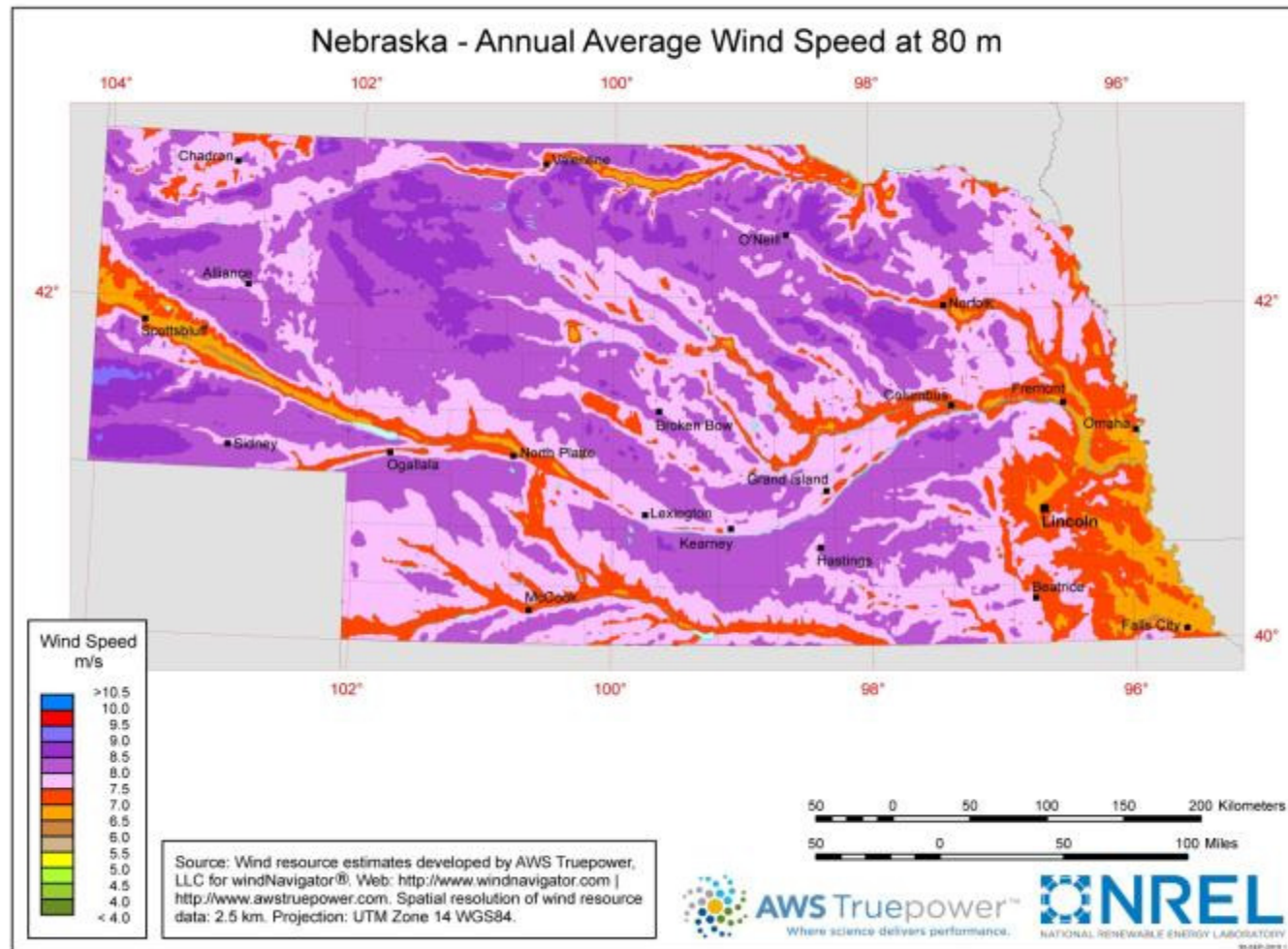
# Wind Energy Potential @ 80m

United States - Land-Based and Offshore Annual Average Wind Speed at 80 m



[http://www.nrel.gov/gis/images/80m\\_wind/awstwspd80onoffbigC3-3dpi600.jpg](http://www.nrel.gov/gis/images/80m_wind/awstwspd80onoffbigC3-3dpi600.jpg)

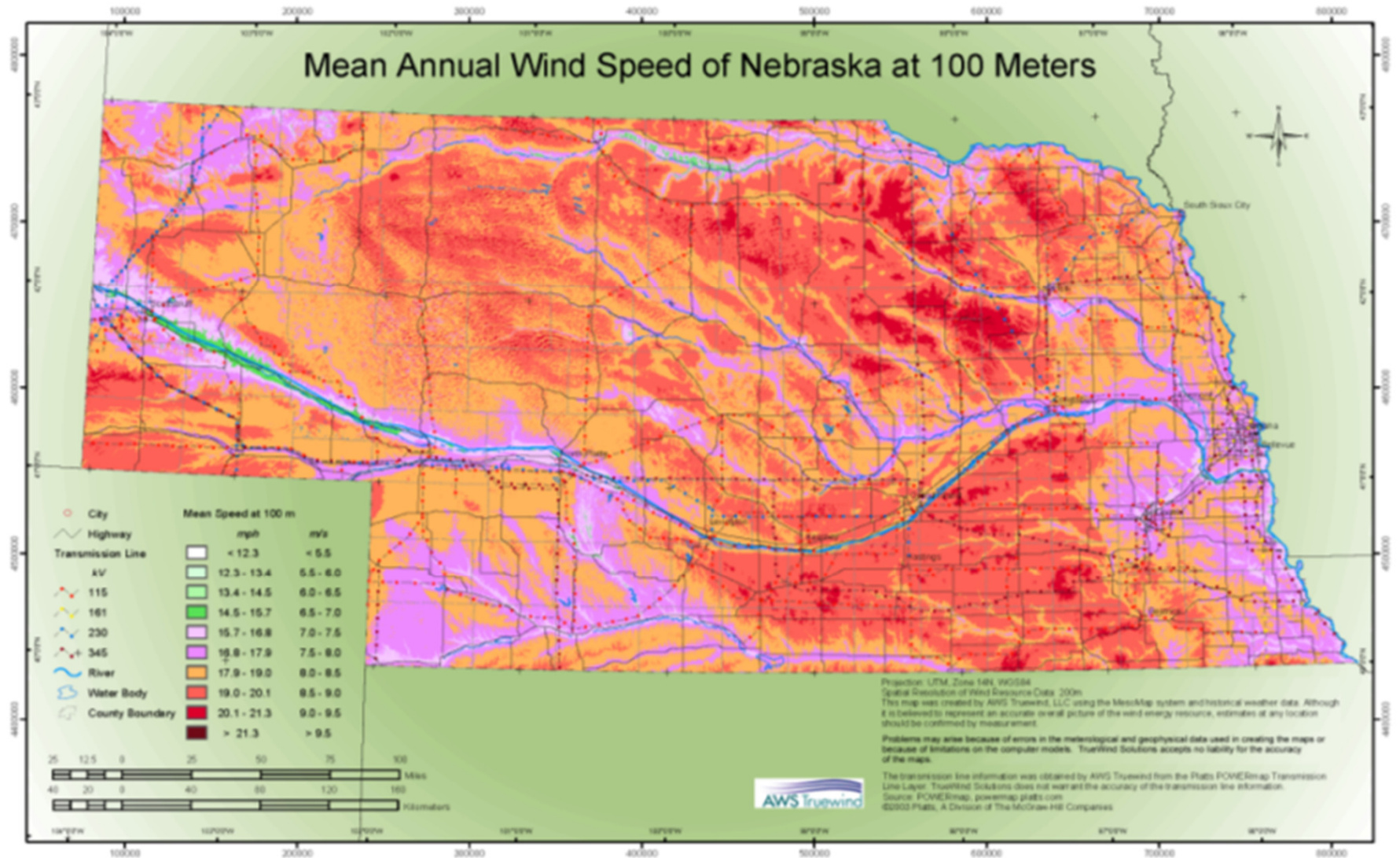
# Nebraska Wind Energy Potential (80m)



**Ranked 3<sup>rd</sup> in the U.S. for potential wind power generation.**

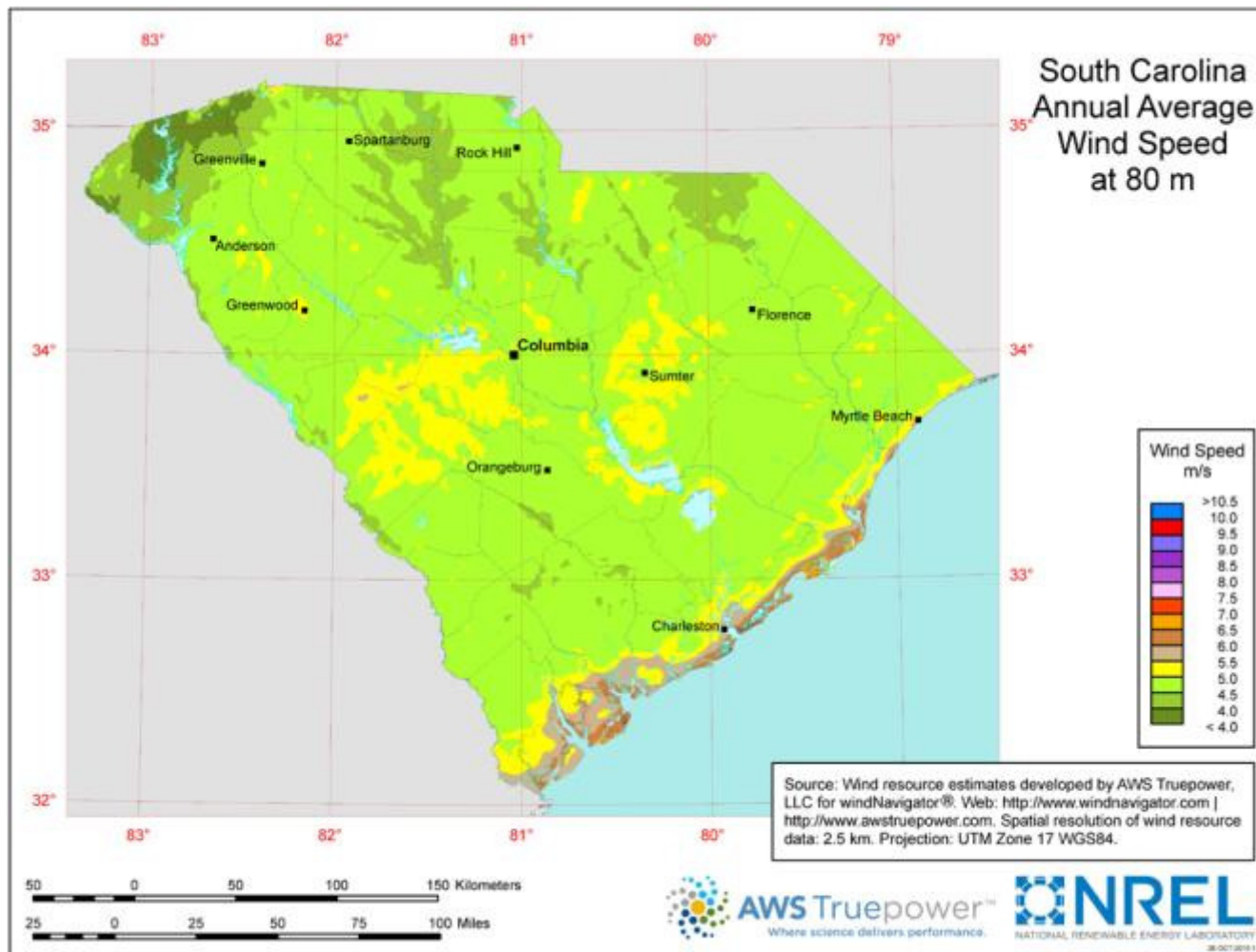
[http://www.windpoweringamerica.gov/images/windmaps/ne\\_80m.jpg](http://www.windpoweringamerica.gov/images/windmaps/ne_80m.jpg)

# Nebraska Wind Energy Potential (100m)



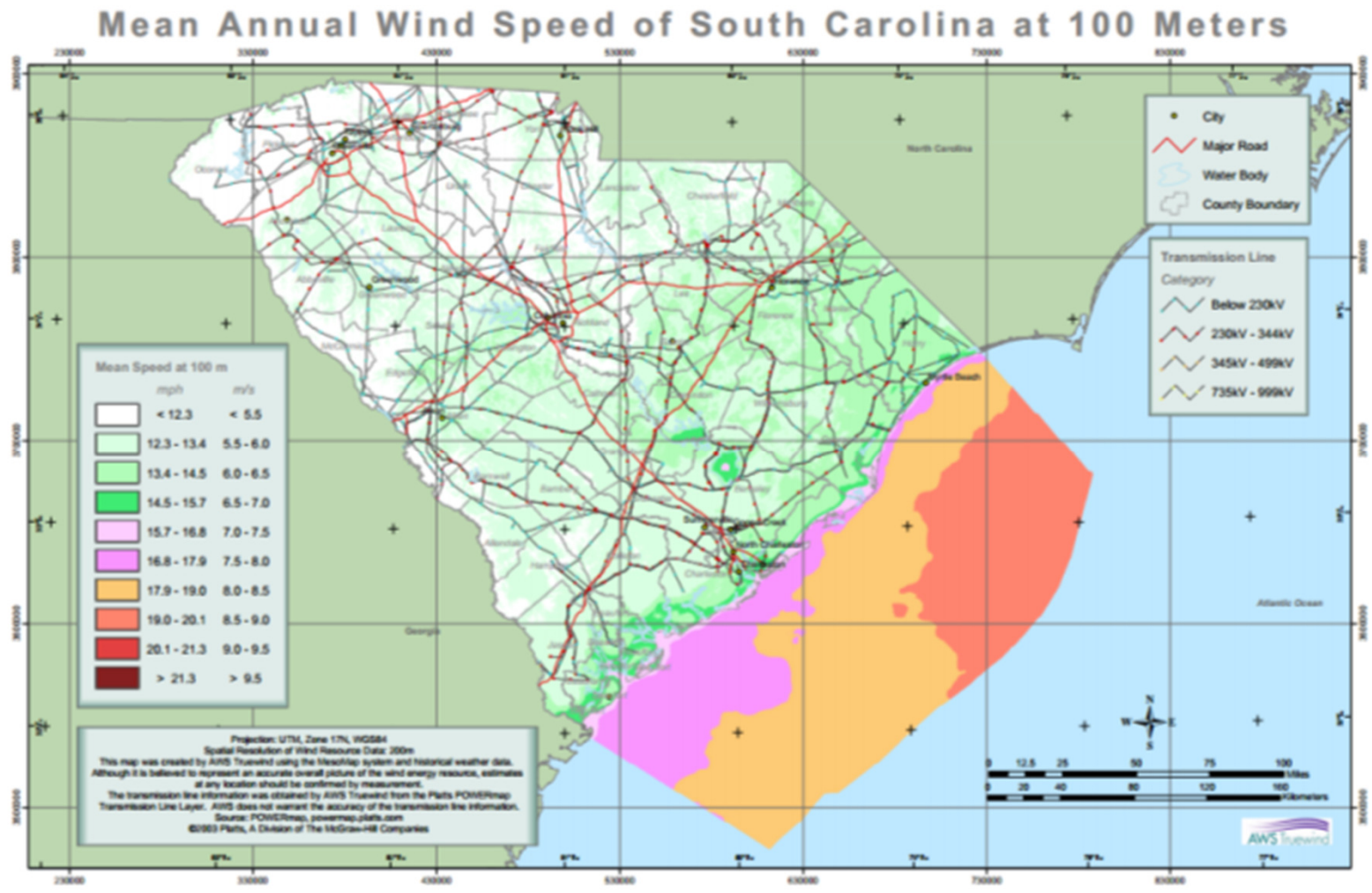
[http://www.neo.ne.gov/renew/windresources/NE\\_spd100m\\_0408052.pdf](http://www.neo.ne.gov/renew/windresources/NE_spd100m_0408052.pdf)

# South Carolina Annual Average Wind Speed (80 m)



[http://www.windpoweringamerica.gov/wind\\_resource\\_maps.asp?stateab=sc](http://www.windpoweringamerica.gov/wind_resource_maps.asp?stateab=sc)

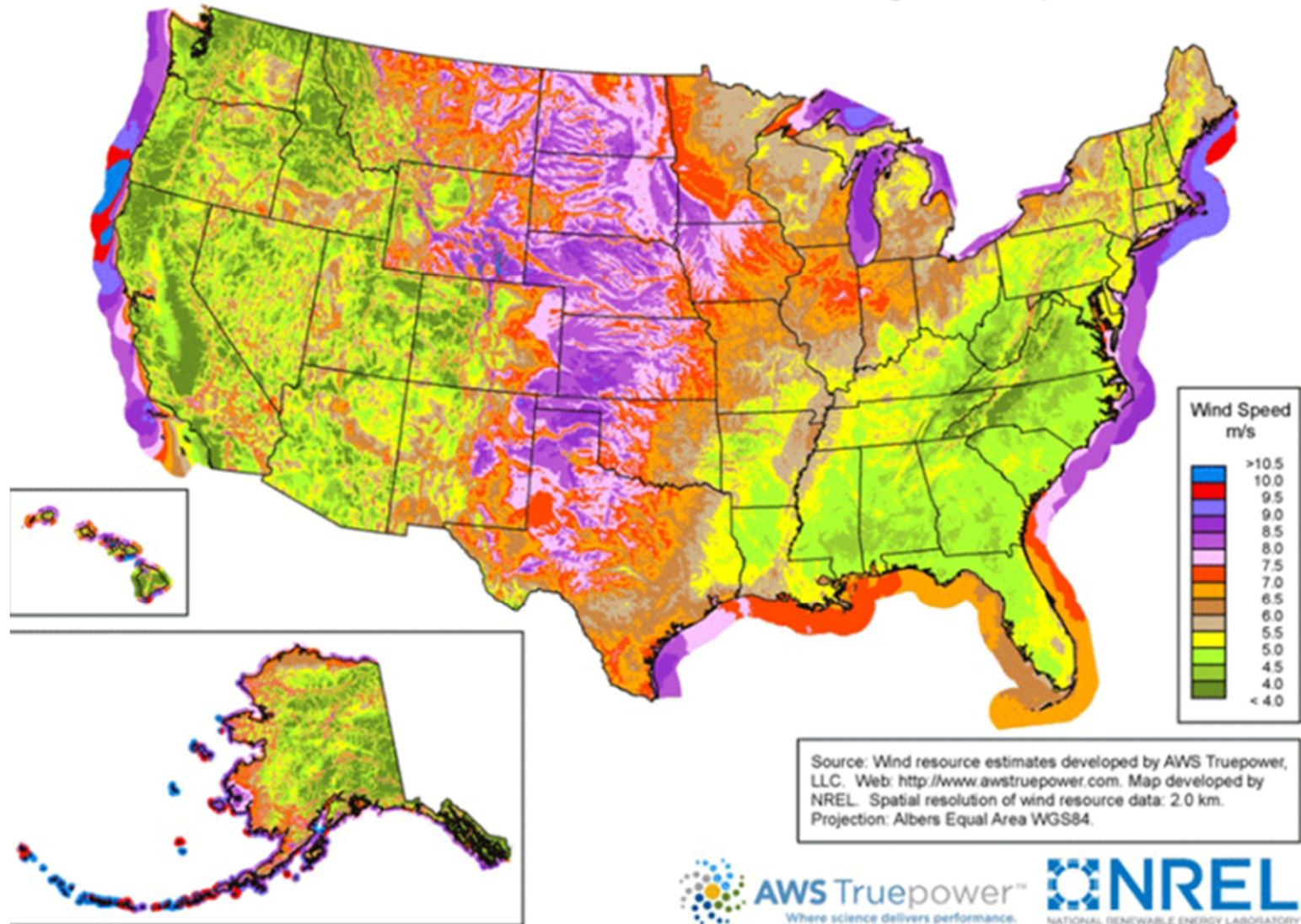
# South Carolina Annual Average Wind Speed (100 m)



[http://www.energy.sc.gov/publications/SC\\_spd100m\\_8April2005.pdf](http://www.energy.sc.gov/publications/SC_spd100m_8April2005.pdf)

# Wind Energy Potential @ 80m

United States - Land-Based and Offshore Annual Average Wind Speed at 80 m



[http://www.nrel.gov/gis/images/80m\\_wind/awstwspd80onoffbigC3-3dpi600.jpg](http://www.nrel.gov/gis/images/80m_wind/awstwspd80onoffbigC3-3dpi600.jpg)

# American Bird Conservancy Wind Development Bird Risk Map

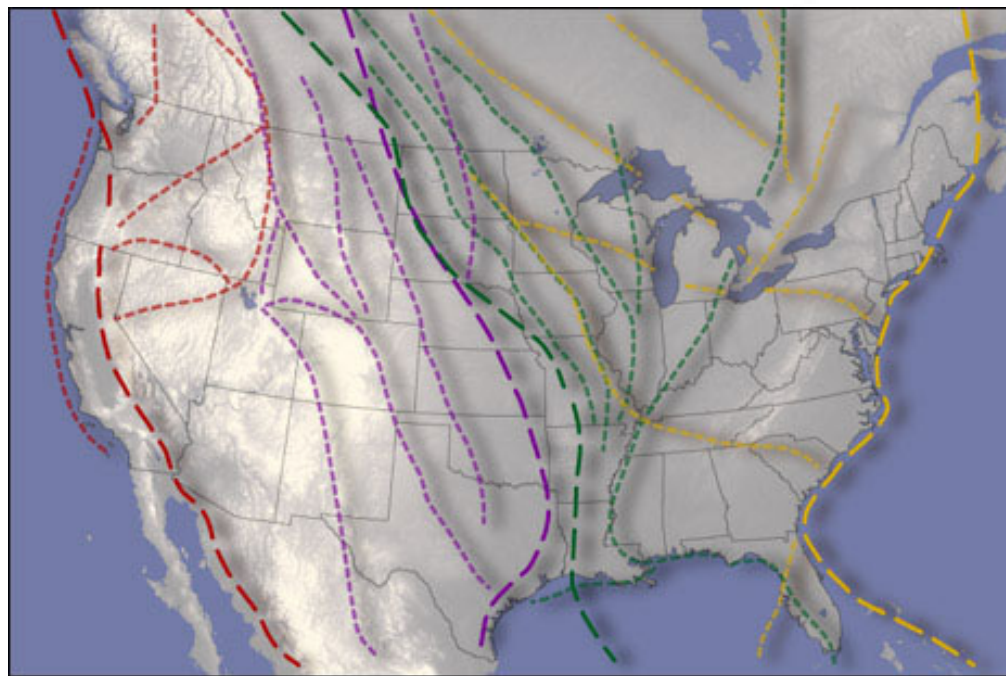


<http://www.abcbirds.org/extra/windmap.html>

Google Earth



# Bird Migration Flyways



Pacific — Central — Mississippi — Atlantic

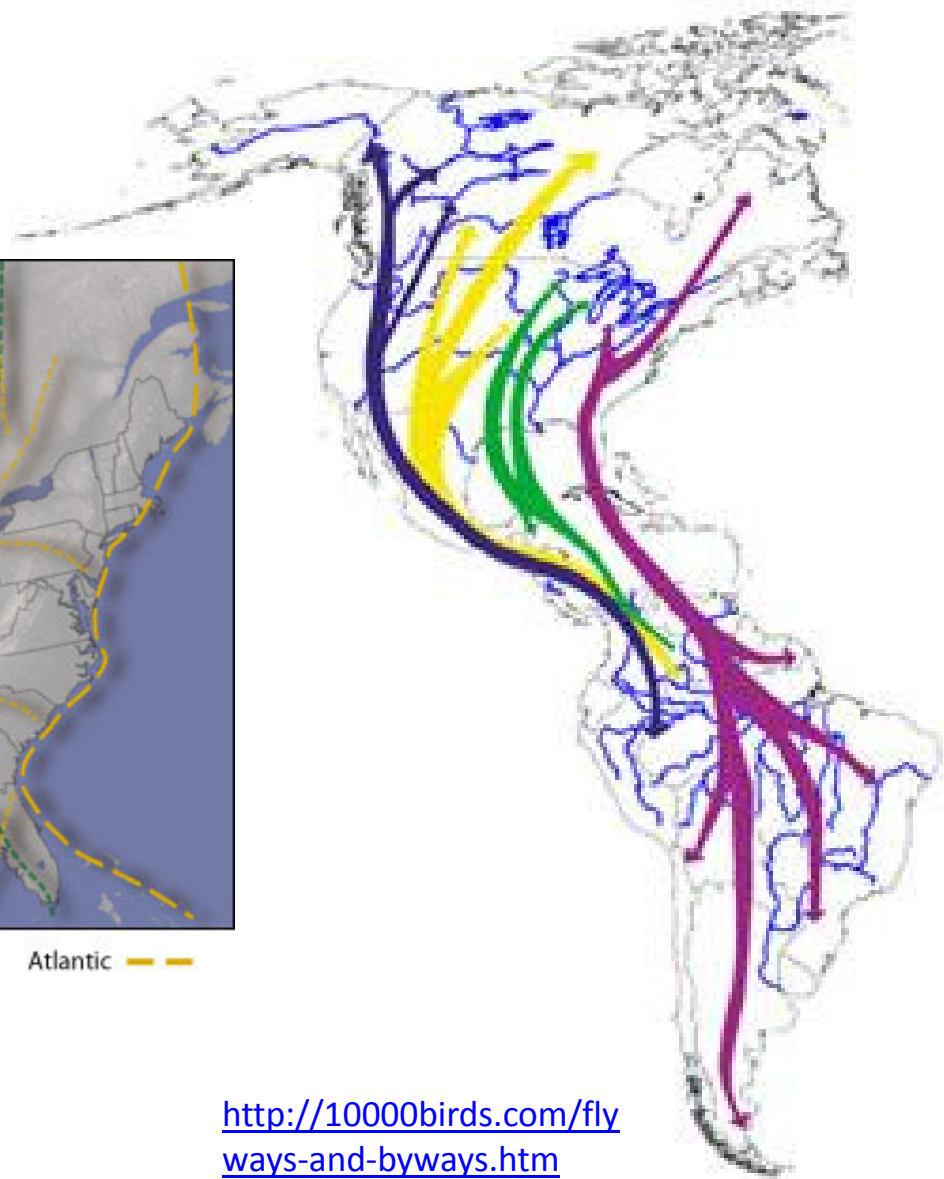
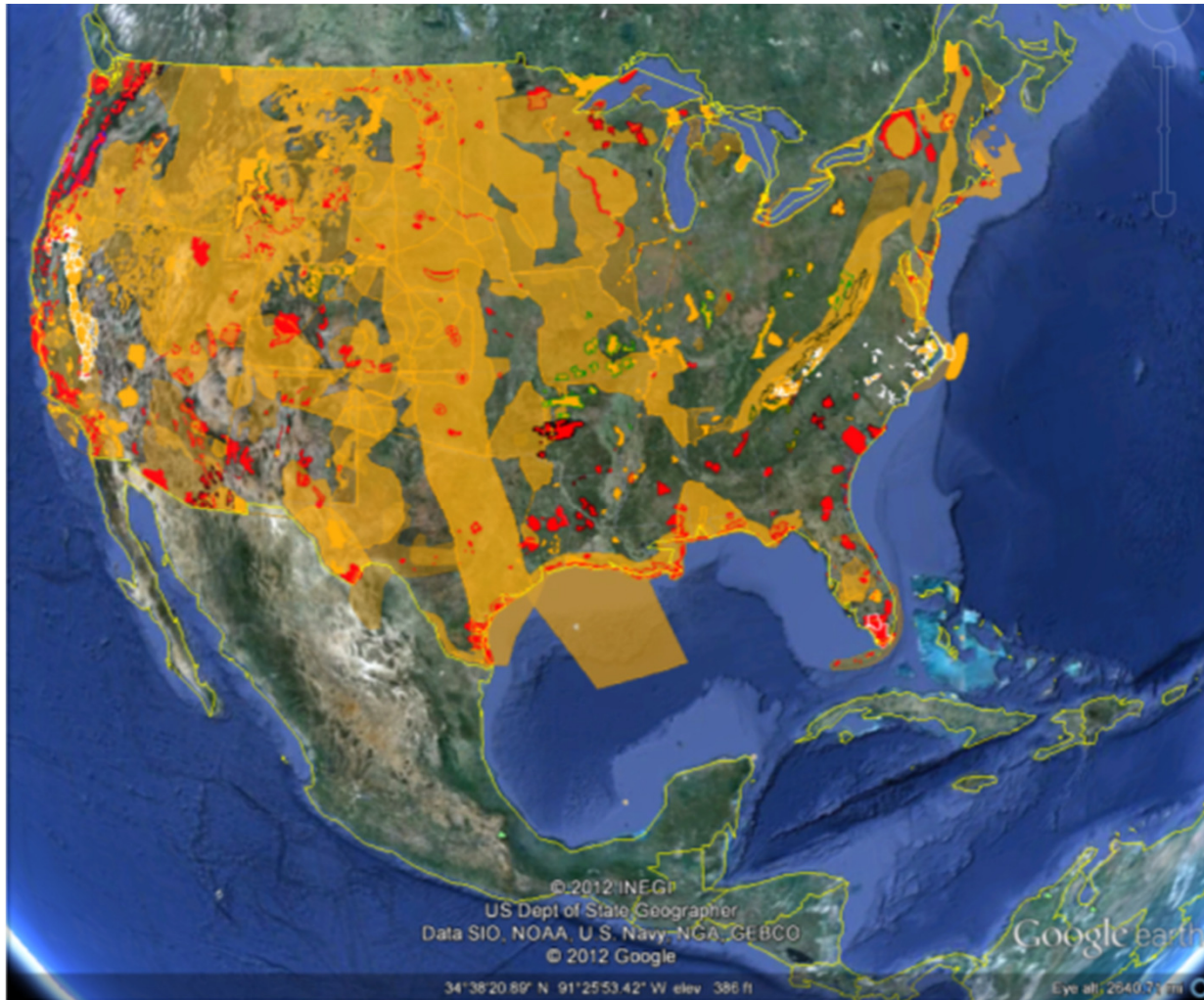


Image: Hunter Allen

(<http://www.climatewatch.noaa.gov/article/2010/watching-birds>)

<http://10000birds.com/flyways-and-byways.htm>

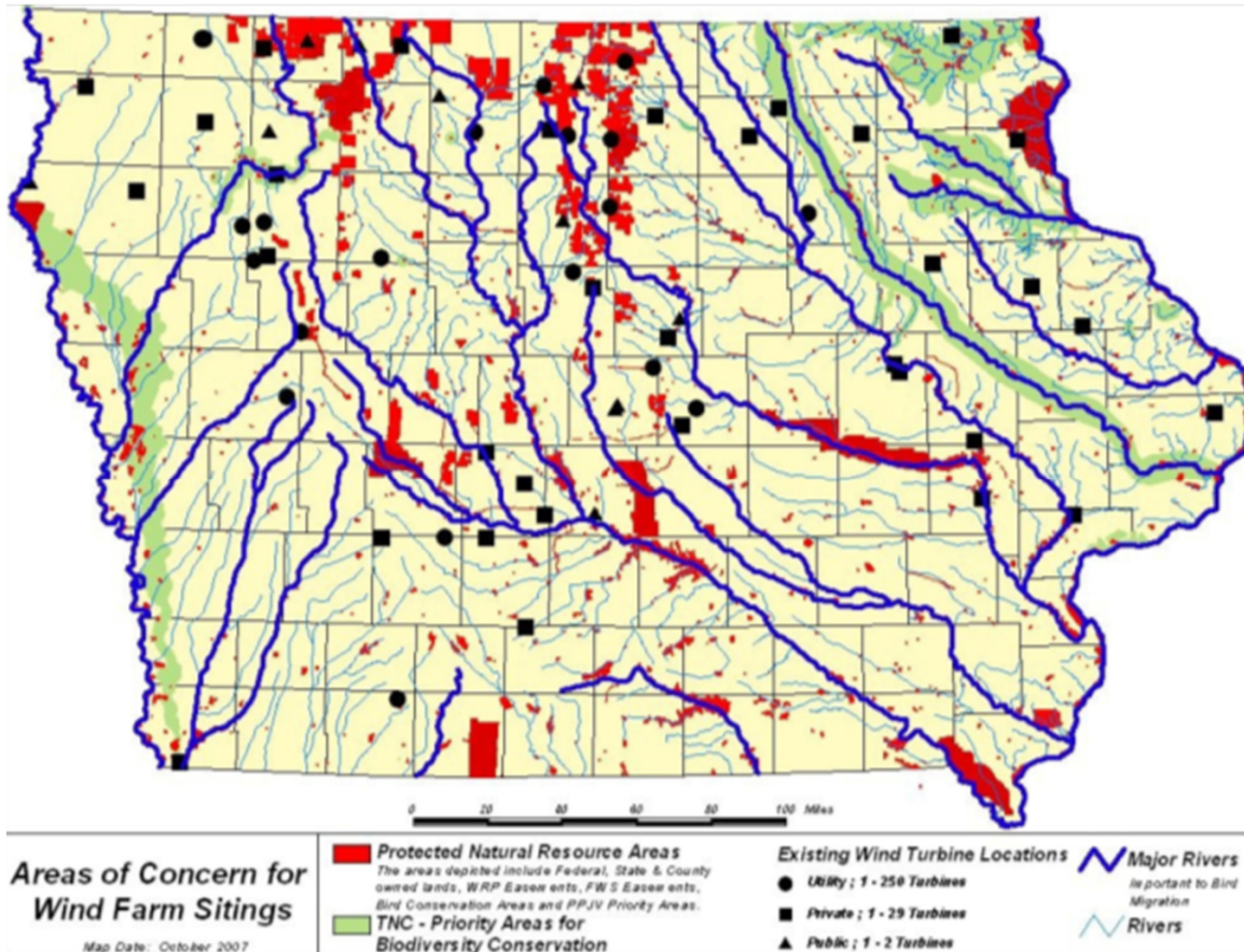
# American Bird Conservancy Wind Development Bird Risk Map



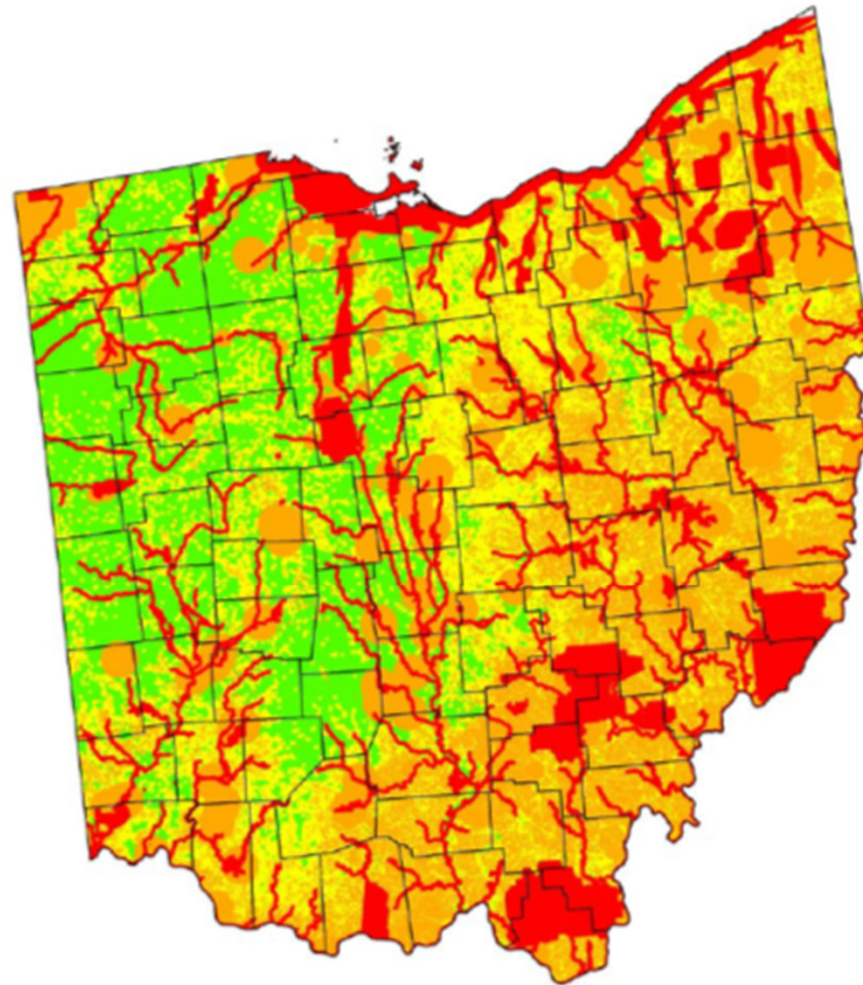
<http://www.abcbirds.org/extra/windmap.html>

Google Earth

# Iowa Areas of Concern for Wind Farm Sitings



# Ohio Map of Survey Effort

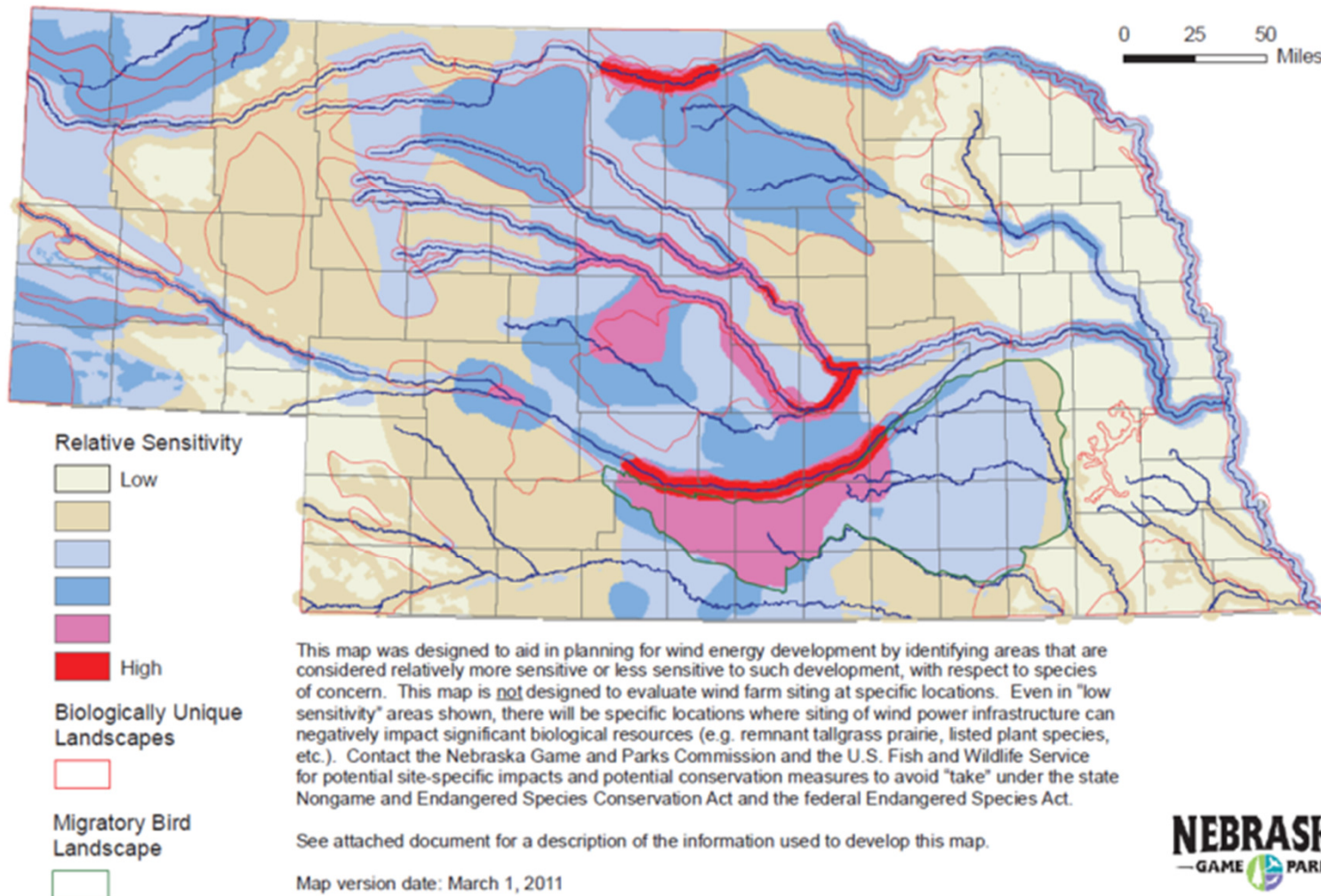


0 20 40 80 Miles

- Minimum
- Moderate
- Moderate (where applicable)
- Extensive

# Wind Energy & Nebraska's Wildlife Map

Wind Energy and Nebraska's Wildlife:  
An index of the sensitivity of wildlife habitats to wind energy development,  
based on selected at-risk species



# Potential Benefits of Wind Power in NE

Developing 1,000 MW of new wind power in Nebraska:

- **Cumulative** economic benefits: \$1.1 billion
- **Annual** CO<sub>2</sub> Reductions: 4.1 million tons,
- **Annual** Water Savings: 1,840 million gallons.



# Nebraska Wildlife & Habitat Value

- Hunting and wildlife viewing provide recreation, food or fur, and tourism income
- For example: Monies earned for the Sandhill crane migration for the central Nebraska economy is estimated at \$10.33 million per year (Edwards & Thompson, 2009)



Sandhill Cranes

Photo: TJ Fontaine

# Laws Protecting Wildlife

- Federal Endangered Species Act
- State Endangered Species Act
- Migratory Bird Treaty Act of 1918
- Bald and Golden Eagle Protection Act







# Federal Endangered Species Act

- Passed by Congress and effective on December 28, 1973.
- Established due to the extinction and/or depletion of fish, wildlife, and plant species in the United States as a consequence of economic growth and development untempered by adequate concern and conservation.
- Prohibited Acts: possess, sell, deliver, carry, transport, or ship, buy any means whatsoever, any such species listed as threatened or endangered.
- The penalty for the unlawful **take** of an endangered species is a fine of up to \$100,000 and/or up to 1 year in jail.
- “**Take**” = harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to do any of these.

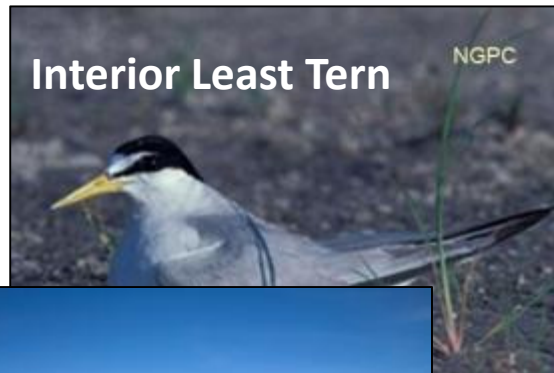
# Federally Listed Species

**Threatened: 317 species**

**Endangered: 1077 species**



**Whooping Crane**



**Interior Least Tern**

NGPC



**Piping Plover**

Joel Jorgensen



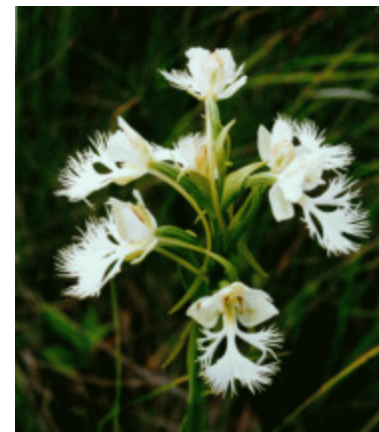
**Salt Creek Tiger Beetle**

Photo by: Seth Willey



**Black-footed Ferret**

Photo: R. List



**Western Prairie Fringed Orchid**

Photo by: G. N. Rysgaard

# Whooping Cranes in Nebraska

- The ONLY natural, self sustaining migratory flock
- In the winter of 1941-1942, only 16 birds remained
- Currently ~300 birds
- Endangered
- Species of concern for wind energy developers



# Nebraska Non-game and Endangered Species Conservation Act

Protects species from harassment, harm, pursuit, hunting, wounding, killing, trapping, capturing, and collecting = TAKE (Neb. Stat 37-804)

**Endangered**



**Swift Fox**

Photo: USFWS



**River Otter**

Photo: Nicole Duplaix

**Threatened**



**Small White Lady's Slipper**

Photo by: Susan R. Crispin



**Mountain Plover**

© Brian E. Small



# Migratory Bird Treaty Act of 1918

- All migratory birds or any part, nest, or egg of any such bird are fully protected by law.
- Treaties or Conventions are between the United States and Canada, Japan, Mexico, and Russia.
- Prohibited actions (unless permitted by regulations) are:
  - pursue, hunt, take, capture, kill,
  - attempt to take, capture or kill,
  - possess, offer for sale, sell, offer to purchase, purchase,
  - deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported,
  - carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export

# International Migratory Bird Treaty Act

- Over 860 species of migratory birds in North America – only 58 have designated hunting seasons – ALL others are protected



Photos by: Phil Swanson  
<http://www.nebraskabirdlibrary.org/>

# Migratory birds in Nebraska



- The Rainwater Basin in south central Nebraska, is the narrowest portion of the Central Flyway.
- 3- 6 m snow geese, 4 m mallards, ~1 m white-fronted geese, ~1 m pintails, and many more, including cranes, fly through in the spring.



# Bald and Golden Eagle Protection Act

- Enacted in 1940, prohibits anyone, without a permit issued by the Secretary of the Interior, from "**taking**" eagles, including their parts, nests, or eggs.
- The Act defines "**take**" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or **disturb**."
- "**Disturb**" means: "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, **1)** injury to an eagle, **2)** a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or **3)** nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior."



# Bald and Golden Eagle Protection Act



- In January 2012, a wind energy developer applied for a take permit for golden eagles in Oregon - 1<sup>st</sup> time in history
- USFWS is reviewing regulations – increase permit time period from 5 to 30 years to facilitate the responsible development of renewable energy and other projects



How can wind energy and  
wildlife co-exist?

# Potential Impacts of Wind Energy Development on Wildlife



Wind energy development can have **direct** and **indirect** impacts on wildlife.



# Potential Impacts of Wind Energy Development on Wildlife

- **Direct** impacts or mortalities are easier to study and have been the focus of most post-construction monitoring efforts.
- **Indirect** impacts have the potential to impact the ecosystem.

# Potential Direct Impacts to Birds - 1

Birds can have fatal collisions with wind turbines and/or associated transmission lines.

- Range from 0 up to more than 30 collisions/turbine/year (Kuvlesky et al. 2007).
- Passerines (night migrants in particular) ~ 2.19 birds/turbine/year for wind farms located on rangelands, agricultural lands, or woodlands in the U.S. (Erickson et al. 2001)



# Potential Direct Impacts to Birds - 2

- Altamont Pass Wind Resource Area, California was established in the 1980s
  - 0.15 birds/turbine/year (Erickson et al. 2001)
  - ~881 - 1,300 birds/year (Thelander 2004)
  - ~570 – 835 raptors/year (Smallwood and Thelander 2005)



# Altamont Pass Wind Resource Area

## Video

- <http://science.kqed.org/quest/video/fatal-attraction-birds-and-wind-turbines/>



[http://en.wikipedia.org/wiki/File:Wind\\_energy\\_converter5.jpg](http://en.wikipedia.org/wiki/File:Wind_energy_converter5.jpg)



# Mitigation

- Impacts to protected species have to be mitigated.
- **Avoid, Minimize, Mitigate**
- It is best to AVOID impacts, if possible.
- Next, MINIMIZE impacts as much as possible.
- Lastly, MITIGATE impacts – mitigation will be determined by regulatory agencies.



# Bats of the U.S. - 1

- 47 kinds of bats
- Most require rocks or crevices for protection
- Forested areas along rivers and in cities (buildings)
- Resident and migratory species



Eastern red bat . Geluso.

## Bats of the U.S. - 2

- Consume night-flying insects, some of which can cause crop damage
- Study: Loss of bats in NA could lead to ag losses estimated at more than \$3.7 billion/year (Boyles et al. 2011).



Eastern pipistrelle  
hibernating in mine near  
Scotia, NE. Geluso



# Potential Direct Impacts to Bats

- Bats can have fatal collisions with wind turbines and/or associated transmission lines.
- The sudden drop in air pressure around wind turbines can cause internal hemorrhaging or barotrauma which causes death in bats.
  - Bat collision rates range from 0-70+ bats/turbine/year.
  - ~975,000 bats killed by wind turbines between 2000-2011.
  - Estimated fatalities in 2012 are between 196,000 and 395,000.
  - Great Plains and Midwest Forest-Ag regions have highest rates of mortalities.

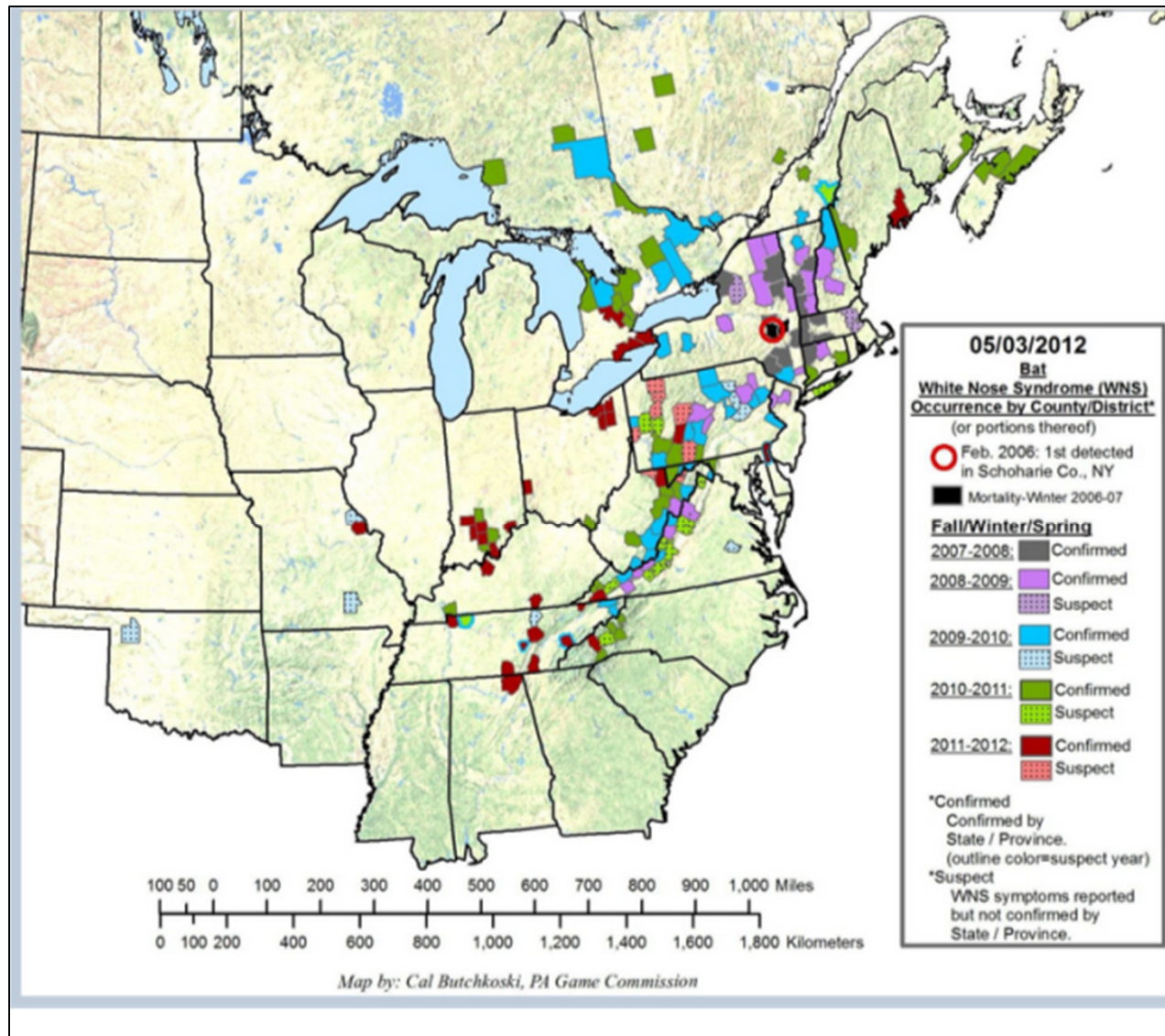
# White-nose Syndrome

- First noticed by cavers in 2006 when they found large numbers of dead bats.
- Estimated to have killed over 5.5 million hibernating bats (USFWS 2012).



USFWS image

# White-nose Syndrome Map



[http://www.fws.gov/whitenosesyndrome/maps/WNSMAP05-03-12\\_300dpi.jpg](http://www.fws.gov/whitenosesyndrome/maps/WNSMAP05-03-12_300dpi.jpg)



# Bats of NE - WNS & Wind Energy

- **Big Brown Bat (*Eptesicus fuscus*) - WNS**
- Brazilian Free-tailed Bat (*Tadarida brasiliensis*)
- **Eastern Red Bat (*Lasiurus borealis*)**
- Evening Bat (*Nycticeius humeralis*)
- Fringe-tailed Myotis (*Myotis thysanodes pahasapensis*)
- **Hoary Bat (*Lasiurus cinereus*)**
- **Little Brown Bat (*Myotis lucifugus*) - WNS**
- Long-legged Myotis (*Myotis volans*)
- Northern Long-eared Myotis (*Myotis septentrionalis*) - **WNS**
- **Silver-haired Bat (*Lasionycteris noctivagans*)**
- Townsend's Big-eared bat (*Corynorhinus townsendii*)
- **Tri-colored Bat (*Perimyotis subflavus*) - WNS**
- Western Small-footed Myotis (*Myotis ciliolabrum*)

# WNS & Wind Energy

- Wind energy development and White-nose syndrome (WNS) are identified as major threats to bat populations.
- Efforts are being made to stop the spread of WNS.
- What can be done to minimize impacts of wind energy development?



Photo: Keith Geluso



# Ways to Minimize Direct Impacts- 1

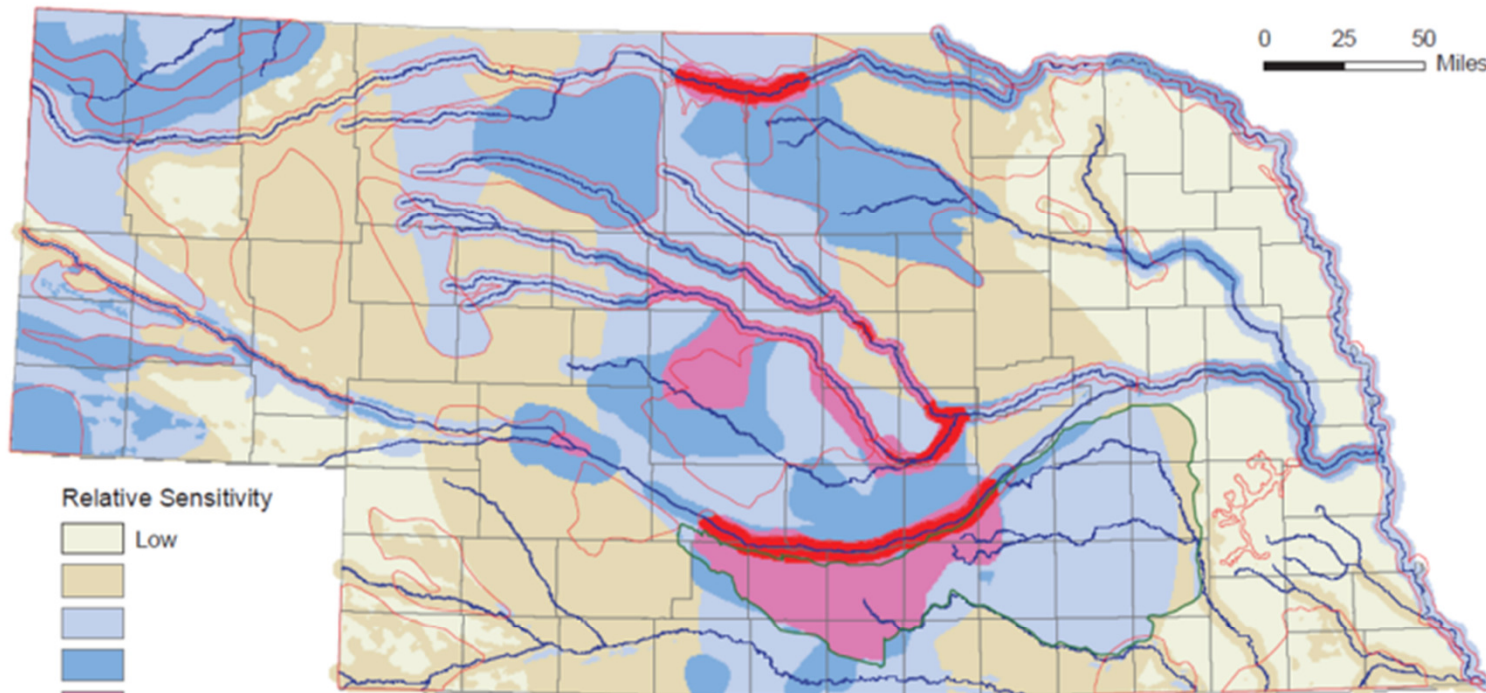
## SITING

- Take into consideration bird & bat presence in the area – local and migratory
- Habitat type – agricultural, river valleys, etc.
- Proximity to water, forest edge, caves or other structures



# Wind Energy & Nebraska's Wildlife Map

Wind Energy and Nebraska's Wildlife:  
An index of the sensitivity of wildlife habitats to wind energy development,  
based on selected at-risk species



## Relative Sensitivity



## Biologically Unique Landscapes



## Migratory Bird Landscape



This map was designed to aid in planning for wind energy development by identifying areas that are considered relatively more sensitive or less sensitive to such development, with respect to species of concern. This map is not designed to evaluate wind farm siting at specific locations. Even in "low sensitivity" areas shown, there will be specific locations where siting of wind power infrastructure can negatively impact significant biological resources (e.g. remnant tallgrass prairie, listed plant species, etc.). Contact the Nebraska Game and Parks Commission and the U.S. Fish and Wildlife Service for potential site-specific impacts and potential conservation measures to avoid "take" under the state Nongame and Endangered Species Conservation Act and the federal Endangered Species Act.

See attached document for a description of the information used to develop this map.

Map version date: March 1, 2011



# Ways to Minimize Direct Impacts- 2

## OPERATIONAL SOLUTIONS = Curtailment

- **Bats:**

- **Increase cut-in speed** - wind turbine speed – slower = more deaths

- Study – curtailment during 2.5 month migration period would reduce total electricity output by less than one percent for the year

- **Feather blades** – reduces tip speeds to almost 0 mph (Young et al. 2009)

- Study – greatly reduced mortality; 1<sup>st</sup> part of the night was more effective; when automated, mortality was even further reduced



# Ways to Minimize Direct Impacts- 3

## ENGINEERED SOLUTIONS

- Tower design – lattice = may attract birds to perch, single pole = better option
- Lighting – may attract insects, birds, & bats
- Bury transmission lines
- Layout of turbines at the wind farm – long strings = more collisions; clusters = fewer
- Radar that detects incoming birds and shuts down turbines



# Ways to Minimize Direct Impacts- Bats

## OTHER SOLUTIONS

- **Color of turbines** – one study found that **purple** turbines attracted fewer insects and therefore bats (Long et al. 2011)
- **Deterrents** – studies being conducted to determine if a device that broadcasts ultrasonic noise placed on turbine could cause bats to avoid the area by interfering with the bat's echolocation system (Bat Conservation International)
  - Study – reduced bat fatalities by 18 – 62%



# Potential Indirect Impacts to Wildlife

- Wind farm construction and infrastructure, including roads and transmission lines, can:
  - fragment habitats,
  - create barriers to migration,
  - introduce invasive species,
  - disturb animal behavior,
  - and/or displace wildlife from an area.
- Potential ways to minimize impacts
  - Reduce project footprint
  - Develop in previously disturbed areas
  - Construction timing



# Wind – Wildlife “Tools”

- *Guidelines for Wind Energy and Wildlife Resource Management in Nebraska*
- *Avian Assessment Guidance for Wind Energy Facilities in Nebraska*
- *U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines*
- *Wind Energy and Nebraska’s Wildlife map*



# Summary

- Wind energy development could be a renewable energy that provides valuable economic growth, environmental benefits, and energy security, but the potential impacts to wildlife and habitat should be taken into consideration.
- Our challenge is to find ways to avoid, minimize, and mitigate the potential impacts of wind energy development on wildlife and habitats.



# Questions?



Photo by: TJ Fontaine