

# Permaculture Cairns March Newsletter

EMPOWERING COMMUNITIES WITH SUSTAINABLE SOLUTIONS



**Care for the Earth, Care for people, Share the excess**

Permaculture Cairns Incorporated

Web Site: [www.permaculturecairns.org.au](http://www.permaculturecairns.org.au)

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## March Meeting & Information Exchange Night

**Tuesday 15<sup>th</sup> March at 6pm for a 6.30pm start**

**Meeting Venue: ARC Disability Centre – 92 Little Street Manunda**

**Members please bring a plate of finger food to share and a friend or two!**

**Members are free but bring some change for a raffle ticket, non-members \$5**

### AGENDA

**Welcome to Members, new Members and Guests**

**Workshops and Events notices**

**Permaculture Principle Number 3 - a practical explanation.**

**Guest Speaker: Sioux Campbell on “Growing resilience in Cairns”**

Queensland’s “summer of disasters” in 2011 highlighted the importance of community preparedness for and resilience to disaster events. Resilience has become an increasingly trendy term, but what is it – and how much of it do we have in the Cairns region? Disaster Resilience Officer with the Cairns Regional Council, Sioux Campbell, will discuss her work in supporting greater resilience, including the results of a recent survey.

Our second guest is Robert de Rooy who has invented a cover for the veggie garden and he will be demonstration his “Veggie Net” invention. The net is designed to keep out all the nasty bugs so come see how it works.

If time allows there will be a few brief items on some of the following topics, Book review, Plants, Tools, Tips, Weeds, Pests, Recipes. And if you have something to add please speak up.

About 8.15 we break for a cuppa and nibbles and a chance to network with likeminded people.

Check out the books in our Members Library – We are finished and on the way home by 9.00pm

**MEMBERSHIP FEES FOR 2016 ARE NOW DUE AND PAYABLE!!!!!!!**

**DATE CLAIMER !!!!!**

**PERMACULTURE CAIRNS INC**  
**INTERNATIONAL PERMACULTURE DAY**  
**Sunday 1<sup>st</sup> MAY 2016**

**Planning is in progress for our most important day!!! Be part of it.**

There is still time to be part of this event, would you like to help us plan, or take part in activities or organise an activity, we would love to have you on board. We need you to speak up NOW. We will need volunteers on the day. It's fun and you get to meet some great people.

If you would like to have a stall to sell a product, plants, seedlings, craft items, chooks, garden items, have a display, hold a workshop, make a demonstration, or presentation please contact us at [info@permaculturecairns.org.au](mailto:info@permaculturecairns.org.au) or talk to a committee member  
**ASAP**

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**Principle No. 3: Obtain a yield**

**“You can't work on an empty stomach”**

Ensure that you are getting truly useful rewards as part of the work that you are doing. The icon of this design principle, a vegetable with a bite out of it, shows us that there is an element of competition in obtaining a yield, whilst the proverb “You can't work on an empty stomach” reminds us that we must get immediate rewards to sustain us.

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**Growing food in the Wet Tropics in March**

This month the weather will still be a bit hot and humid, and we can still get heavy rain, so work in the early mornings and late in the day to prepare the garden for planting the cool weather plants in April. Start going through seed catalogues or the fridge if you are a seed saver and decide which veg you would like to eat later this year.

Seed your favourites into punnets or small pots this month. These plants will be ready in 4 weeks to plant out. A seedling mix needs to drain well, hold moisture and not have any bad pathogens. I have found Searles premium potting mix makes a good seed raising and potting mix.

Here are some of the great veg to seed into punnets now, full sun is good but out of heavy rain:- eggplant, tomatoes, capsicum, chilli, celery, Florence fennel, kale, broccoli, cabbage, leek, rosella, silverbeet, and Mediterranean herbs.

Direct seed into garden bed, leaf amaranth, snake beans, daikon radish, beetroot, bok choy, rocket, pumpkin, and melons. Give French beans a go now, they may grow depending on the weather, if not you have only lost a few seeds.

If you are late planting your seeds, buy some seedlings, pot them up and grow on ready to plant when the weather is cooler and the risk of heavy rain is unlikely. Beans, melons, cucumbers all grow better if direct seeded so don't buy seedlings of these. Grow in full sun.

Meanwhile in the garden build your compost heap, when it heats up too hot to put your hand into, give it a turn by moving the outside into the centre and cover with the outside materials, then turn again in 3/4 days and again in 3/4 days and again in 3/4 days and then let it rest for a week or two or until you need to spread it on the garden. Mix it up before using.

Gather materials for composting and keep them moist, they will break down faster. I have found the soil underneath a compost heap to be full of microbes and insects and has a light silky texture, smells great and plants love it, so build you heap where you plan to grow your veggies.

If you have sandy soil you will need to add nutrients and lots of organic matter each year. So when making compost add minerals, biochar or zeolite (both work as storage units for microbes and nutrients) worm juice, manure or blood and bone, some soil and some compost from your last heap.

When preparing the bed for planting, use a balanced fertilizer which includes the essential trace elements. I find Nutri Tech Gold to be excellent. Only available from Enviromart on corner Scott and Aumuller Streets. By using a balanced fertilizer the plant receives all it needs to get started. This makes the plant less attractive to pests and diseases. Feed plants fortnightly with a foliar spray to keep them supplied with all the nutrients.

And don't forget to keep the soil mulched at **all times**, mulch adds nutrients, keep soil cool and moist, stops erosion, and stop those persistent weeds from germinating.

Written by Carol Laing, [newsletter@permaculturecairns.org.au](mailto:newsletter@permaculturecairns.org.au)

## Happy Nutritious Gardening

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### CAN YOU HELP!!!!!!

Demi needs your help.

Demi is a 15 years old cancer patient living in Mirriwinni. She has had multiple treatments and surgeries but there are now inoperable tumors in her lungs.

Demi needs to eat only organically grown vegetables. If you are a Certified Organic Grower of Vegetables, and you would like to help Demi until her new organic veggie garden starts producing, could you please contact Melanie on 4067 2900 or 0408093393

### AND

The Endeavour Cairns Learning and Lifestyle are looking for a volunteer with Horticulture experience to assist us in the provision of a gardening/sustainable living program based at our centre. Our horticulture experience is limited here at the centre and we hope that the volunteer will be able to develop a suitable program with us. We envisage that the program will run 2 session a week for up to two hours. If you require any additional information please contact us by phone on 4040 4609 or via this email. **From:** Melissa Fehlhaber <[m.fehlhaber@endeavour.com.au](mailto:m.fehlhaber@endeavour.com.au)>

## LOCAL WORKSHOPS AND EVENTS

### BIODYNAMICS FAR NORTH QUEENSLAND

#### PLANTING CALENDAR -

#### WORKING WITH THE MOON CYCLES AND PLANETS

Sunday 13<sup>th</sup> March 10am to 4pm

Learning optimal times for planting and working with your garden and crops

Walk around Jutta's lovely Biodynamic garden after lunch.

Bring your 2016 Astro Calendar or you can purchase from Tim.

You can also renew your membership if you have not already done so.

Bring lunch to share and a chair.

Address: At Jutta Linnewebber's - 326 Pickford Rd, Biboora

From Mareeba on Cooktown Rd, to Biboora. Turn left into Pickford Rd, at Biboora Service Station (go 3 1/2 km down road). Alternative venue if flooding ring Hilary.

For further information Phone Hilary 0427 392753 or Simon on 40977837

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### Steam Weeding Field Days

Blue Hand Steam presents a Safe weed control solution to FNQ

#### Field Day Program

Cairns Field Day - Thursday 31st March - 10am till Midday  
250 Lower Freshwater Rd, Freshwater

Innisfail Region Field Day - Friday 1st April - 10am till Midday  
RP 293 Pullom Rd East, Palmerston

Tablelands Field Day - Saturday 2nd April - 10am till Midday  
Brolga Pass - 254 Picnic Crossing Road, Yungaburra

Steam Weeding units designed and developed in Australia have been successfully used by councils, landcare groups, nurseries, maintenance contractors and farmers for over 15 years.

*You will learn about the SteamWand SW range of steam weeding units which can be used for weed control in agriculture, horticulture, urban streetscapes, regeneration areas, parks, playgrounds and schools.*

*We will be discussing the cost effective options available and how to apply Steam weeding technology into your farm, organisation or business.*

## Community Foods – Job Vacancy

We have a 25 hour week permanent part-time Co-ordinator position available.

Immediate start preferred.

Application will be accepted until Saturday March the 12<sup>th</sup> at 5pm.

Please see our website for the job description and how to apply.

The Team at Community Foods Co-op

**Address:** 74 Shields St, Cairns QLD 4870

**Phone:** 07 4041 5335

**Email:** [shop@comfoods.org.au](mailto:shop@comfoods.org.au)

**Website:** <http://www.comfoods.org.au>

## FNQ COMMUNITY EXCHANGE March Calendar

Relocalising all of Far North Queensland

LETS is a Community Trading System which uses "Bartles" for trading.

MALANDA - Saturday 5th 10 – 12 noon. Malanda Trade in the Park. Eacham Memorial Park, opposite the post office. Bring along morning tea to share, something to trade and display your wares. There is a shelter, so it's an all weather event. Event host: Katrin 40966755.

KOAH – Saturday 5th 9am – 1pm Monthly Market and Trade at Koah Community Hall. You are invited to be part of the local Koah Monthly Market, an excellent family friendly venue. This is a traditional market style with the option to trade in Bartles. \$5 per stall or 5B, set up from 8am. If you want to register, visit the "Koah Monthly Market" facebook page or just come on the day.

EVENT HOST: Tonielle - 0422058995

CASSOWARY COAST - Sunday 6th Johnstone River Community Garden Picnic Celebrating Clean Up Australia Day, Flying Fish Point Rd, Innisfail. Tropical gardening workshop and garden tour. Activities from 9am. Garden harvest lunch at noon. This is not a LETS event. EVENT HOST: Bernie - 0403523244

### FNQ COMMUNITY EXCHANGE 25th BIRTHDAY PARTY

Saturday March 12th 3pm till 9pm

Yungaburra Community Hall (behind the pub)

Come and bring your trade goods and provide services.

There will be food available and live music to celebrate our wonderful LETS community.

We'll have a Lucky Door Prize and will also raffle a Fantastic Prize at the end of the evening:

2-night Daintree accommodation. Tickets can only be purchased on the day.

This is a family friendly event with many things for the kids to do, like craft, dress up, face painting.

Bring family and friends we love to grow!

EVENT HOST: Katrin – 0417822446

KEWARRA BEACH – Saturday 19th 4.30pm - 8pm Trade Afternoon/Evening. Bring your swimmers if it's still so hot!!!!

Contact Ilona for address and more event details.

EVENT HOST: Ilona - 0438759711

RAVENSHOE - Saturday 19th 12 - 2pm Trade afternoon Youth Shed, Ravenshoe Community Centre, 3 Bolton Street. Following Community Gardens gathering - come and check it out. Child friendly event. Bring something to trade and some lunch to share.

Event host: Kathy - 40977864

MALANDA – Saturday 19th 2pm-4pm Detoxify Your Body at The Closet Hippy, English Street.

Jayne will talk to you about the foods and nutrients that help your body to detoxify and highlights some of the common myths about detoxification. By donation

Do you feel tired all the time? Have difficulty thinking clearly? Do you have bad breath?

Do you have bloating after eating certain foods or other digestive problems?

Do you have allergies, sinus trouble, skin problems or joint pain?

Then your body could benefit from a detox protocol.

Bookings may be made by email or phone. EVENT HOST: Jayne - 0403208551

CASSOWAY COAST\* – Sunday 20th 11am – 3pm LETS Trade. Bring Lunch to share (BBQ available), items to trade, information on services offered and some good conversation as well. Please consider BYO plate & cutlery to save our host excessive dish duties. EVENT HOST: Bernie - 0403523244

\*This event is on the same day as the last day of Feast of Senses at Innisfail a great way to combine a full day out if you are traveling from the Tablelands, Cairns or Tully.

TOPAZ – Wednesday 23rd 10.30am - 2.30pm Felt making Workshop. 1687 Topaz Road. Make basic felt square and felt balls with coloured merino wool. Bring lunch to share. 4 hours allocated for creating felt master pieces but if you are time short Alison can take you through basic felting in an hour. By Bartle donation. EVENT HOST: Alison - 0407777171

YUNGABURRA - Saturday 26th 12 - 2pm that retro café & Red Shed Shops Trade Afternoon. This event is immediately after the Yungaburra Market. Bring along something to trade a rug to display your wares. 100% Bartles for drinks from the menu, you will need cash for lunch and drinks from the display fridge. Event Host: Melitta - 40952340

**CAIRNS CITY - Sunday 27th 12- 2pm - Lafew Teahouse, 33 Sheridan Street. LETS relies on member initiative and participation to make events happen - At Lafew we provide a prime position opposite Rusty's Market. We offer: kombucha, tea and coffee. Available 50/50 Bartles/\$. Bring your trading sheets and goodies. We like to focus on edible plants and would love to see our garden area used as a drop off & pick up for edibles. For new members - please drop by and chat to the LETS traders, you can sign up on the day. Event Host: Lorna - 0475762838**

What to bring to Trade Events where not specified above: food & drinks for yourself or to share, or money and/or Bartles at some venues, friends, Trading Record Sheet and pen, any goods you wish to trade, table/rug to display them upon is often useful, your own chair at some venues, promotional material of any services you are offering if applicable, \$20 to join FNQ Community Exchange if you are not yet a member.

[tablelandlets@gmail.com](mailto:tablelandlets@gmail.com) - 4096 6972 - [www.tablelandlets.org](http://www.tablelandlets.org) - [www.communityexchange.net.au](http://www.communityexchange.net.au)



## NEWS & INFORMATION FROM HOME AND AROUND THE WORLD

### Media Release The Hon. Barnaby Joyce MP Minister for Agriculture and Water Resources

#### Ag White Paper delivers new direction for RD&E

16 February 2016

The Coalition Government has moved to strengthen the targeting of rural research, development and extension (RD&E) funding towards on-farm technologies and practices that deliver farmgate returns with the development of clear farmer, fisher and forester oriented RD&E priorities.

Minister for Agriculture and Water Resources, Barnaby Joyce, said updating these priorities was an Agricultural Competitiveness White Paper initiative that was designed to improve on-farm productivity and maximise benefits to the community.

“The new priorities will see our Rural Research and Development Corporations (RDCs) take a stronger focus on the areas of advanced technology, biosecurity, soil, water and managing natural resources, as well as promoting industry and on-farm adoption of R&D,” Minister Joyce said.

“These priorities were developed in consultation with farmers, researchers and industry through the Agricultural Competitiveness White Paper process, which saw us receive more than 1,000 submissions as well as talking face-to-face with more than 1,100 people across the country.

“Just as other national research priorities are periodically reviewed to ensure they reflect the changing needs of Australians, our rural RD&E priorities are reviewed to ensure that collective investment in R&D continues to deliver maximum returns and benefits to primary producers and the Australian community.

“The RDCs will be required to plan and report on RD&E expenditure against the new priorities, which are consistent with the government’s National Science and Research Priorities and National Innovation and Science Agenda. I have written to the chairs of the 15 rural RDCs to inform them of the new priorities.

“A strong R&D system drives future productivity growth, and effective natural resource management.

“R&D investment delivers productivity returns that far exceed the cost of the investment: for every dollar the government invests in agricultural R&D, farmers generate a \$12 return within 10 years.

“The government and industry together invest around \$550 million annually through the RDCs.

“We are already delivering on our promise to increase R&D funding, through the Rural R&D for Profit Programme. Under the White Paper we have doubled funding for this programme to \$200 million and extended it to 2021-22.

“The new priorities are now also reflected in the Rural R&D for Profit Programme, which encourages innovative partnerships between RDCs and other organisations.

“More than \$26 million in project funding has so far been announced under round one. Round two of the programme closed on 1 December and I look forward to announcing successful projects in the first half of 2016.”

To read the Agricultural Competitiveness White Paper, visit [agwhitepaper.agriculture.gov.au](http://agwhitepaper.agriculture.gov.au).

#### ACCC proposes to conditionally authorise Queensland LNG producers to coordinate their maintenance schedules | ACCC

<http://acc.gov.au/media-release/accc-proposes-to-conditionally-authorise-queensland-lng-producers-to-coordinate-their-maintenance-schedules>

The Australian Competition and Consumer Commission has issued a draft determination proposing to authorise Australia Pacific LNG Pty Ltd, Gladstone LNG, and the Queensland Curtis LNG Project to discuss their maintenance schedules, maintenance providers and maintenance techniques. The ACCC proposes to grant authorisation for five years, subject to a condition. The ACCC has also granted conditional interim authorisation to allow the LNG producers to discuss their plans for maintenance at each facility in the second half of 2016.

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## Australian Renewable Energy Agency

### Refreshed stocktake to help renewables work with the grid

18 February 2016

The Energy Networks Association (ENA), in partnership with the Australian Renewable Energy Agency (ARENA), has released an updated database of Australian and international renewable energy grid integration projects.

The *Integrating Renewables into the Grid Stocktake* catalogues 208 projects that add to Australia's collective knowledge and experience of integrating renewable energy into distribution networks.

ENA CEO John Bradley said Australia's electricity grid was the backbone of the energy system and would play a vital role in Australia's clean energy future.

"There are tangible benefits to be gained from increased integration of renewables into the network, though these come with some economic, technical and regulatory challenges," Mr Bradley said.

ARENA is supporting the development, updating and online hosting of the Stocktake.

ARENA CEO Ivor Frischknecht said enabling renewables and grids to work together effectively would be critical to increasing the supply of renewable energy in Australia.

"Our electricity grids and regulations were designed to cater for centralised power generation from large power plants. As more de-centralised renewable energy comes online, there will be a myriad of challenges and opportunities for utilities, energy retailers and policy makers to work through," Mr Frischknecht said.

"The Stocktake will be invaluable for facilitating this work by providing a one-stop-shop for information on current projects, along with the outcomes of past efforts."

ARENA, ENA and other partners have worked together since the first release in 2014 to ensure the Stocktake remains relevant to interested industry stakeholders.

Mr Bradley said the updated Stocktake would make it easier for the renewables and electricity network sectors to work together.

"It's critical that energy networks, the renewables sector, research institutions and technology developers collaborate to advance the evolution of the energy system."

One such collaboration between the Queensland University of Technology, Ergon Energy, Central Queensland University and international researchers – Planning Future Energy Grids: Renewables – developed viable tools for predicting output from rooftop solar panels and the optimal size and placement of batteries to support network peak demand and avoid network upgrade expenditure.

"This is a vital project given Australia leads the world in the penetration of rooftop solar panels, with 1.5 million installations delivering over 5000 megawatts (MW) of generation capacity," Mr Bradley said.

[View the updated Stocktake database and analysis](#)

**About the Energy Networks Association (ENA)**



The ENA is the national industry association representing Australia's electricity transmission and distribution networks and gas distribution networks. ENA members provide energy to virtually every household and business in Australia.

## About the Stocktake

The latest Integrating Renewables into the Grid Stocktake sees the addition of 15 new Australian projects and updates to 25 existing projects, taking the total number of projects catalogued to 208.

It is of international significance with the inclusion of projects from across the globe – 131 originating in Australia and 77 from overseas.

To be included in the Stocktake, projects must address or inform one or more of 14 defined objectives relating to issues with the integration of renewable energy into the grid. Cataloguing projects on the basis of these objectives assists interested parties to identify projects of relevance to them.

The Stocktake analysis determined the objectives most commonly addressed include: the cost efficiency of renewable energy integration; the development of new business models to cater for a network with a high level of distributed energy resources; and improved network security necessary for higher renewable energy integration.

Through the Stocktake, five projects have been identified as leaders in their field, these being:

- Project 196: King Island Renewable Energy Integration Project (Hydro Tasmania)
- Project 316: PRIME PLC Evaluation (Energex)
- Project 245: Future Grid Forum (CSIRO)
- Project 186: SGSC: Smart Grid, Smart City Project (AusGrid)
- Project 265: Planning Future Energy Grid: Renewables (QUT)

### ARENA media contact

Judith Ion – 0434 169 037

[media@arena.gov.au](mailto:media@arena.gov.au)

### ENA media contact

Simone Reading – 02 6272 1524 or 0447 569 029

[sreading@ena.asn.au](mailto:sreading@ena.asn.au)

### Download media release

[Refreshed stocktake to help renewables work with the grid \(PDF 173KB\)](#)

## Carbon Budget is Only Half as Big as Thought

*LONDON, 25 February, 2016* – Climate scientists have bad news for governments, energy companies, motorists, passengers and citizens everywhere in the world: to contain global warming to the **limits agreed by 195 nations in Paris** last December, they will have to **cut fossil fuel combustion at an even faster rate** than anybody had predicted.

Joeri Rogelj, research scholar at the **International Institute for Applied Systems Analysis** in Austria, and European and Canadian colleagues propose in **Nature Climate Change** that all previous estimates of the quantities of carbon dioxide that can be released into the atmosphere before the thermometer rises to potentially catastrophic levels are too generous.

Instead of a range of permissible emissions estimates that ranged up to 2,390 billion tons from 2015 onwards, the very most humans could release would be 1,240 billion tons.

### Available levels

In effect, that halves the levels of diesel and petrol available for petrol tanks, coal for power stations, and natural gas for central heating and cooking available to humankind before the global average temperature –

already 1°C higher than it was at the start of the Industrial Revolution – reaches the notional 2°C mark long agreed internationally as being the point of no return for the planet.

In fact, the **UN Framework Convention on Climate Change summit** in Paris agreed a target “well below” 2°C, in recognition of ominous projections – one of which was that, at such planetary temperatures, sea levels would rise high enough to submerge several small island states.

The Nature Climate Change paper is a restatement of a problem that has been clear for decades. Carbon dioxide proportions in the atmosphere are linked to planetary surface temperatures and, as they rise, so does average temperature. For most of human history, these proportions oscillated around 280 parts per million.

The global exploitation, on a massive scale, of fossil fuels drove the expansion of agriculture, the growth of economies, a sevenfold growth in human population, a sea level rise of 14cms, and a temperature rise of, so far, 1°C.

To stop temperatures increasing another 3°C or more and sea levels rising by more than a metre, humans have to reduce fossil fuel emissions. By how much these must be reduced is difficult to calculate.

The **global carbon budget** is really the balance between what animals emit – in this context, the word animals includes humans with cars and aeroplanes and factories – and what plants and algae can absorb. So the calculations are bedevilled by uncertainties about forests, grasslands and oceans.

To make things simpler, climate scientists translate the target into the billions of tons of carbon dioxide that, ideally, may be released into the atmosphere from 2015 onwards. Even these, however, are estimates.

There is general agreement that a limit of 590 billion tons would safely keep the world from overheating in ways that would impose ever greater strains on human society. The argument is about the upper limit of such estimates.

Dr Rogelj says: “In order to have a reasonable chance of keeping global warming below 2°C, we can only emit a certain amount of carbon dioxide, ever. That’s our carbon budget.

“This has been understood for about a decade, and the physics behind this concept are well understood, but many different factors can lead to carbon budgets that are either slightly smaller or slightly larger. We wanted to understand these differences, and to provide clarity on the issue for policy-makers and the public.

“This study shows that, in some cases, we have been overestimating the budget by 50 to more than 200%. At the high end, this is a difference of more than 1,000 billion tons of carbon dioxide.”

The same study takes a closer look at why estimates of the “safe” level of emissions have varied so widely.

One complicating factor has been, of course, uncertainty about what humans might do, and another has been about the other more transient greenhouse gases, such as methane and the oxides of nitrogen.

Although short-lived and released in smaller quantities, some of these are potentially far more potent than carbon dioxide as an influence on planetary temperatures.

## **Complex calculations**

But Dr Rogelj and his colleagues found that a significant cause of variation was simply a consequence of the different assumptions and methodologies inherent in such complex calculations.

So the researchers have re-examined both the options and the approaches, and have worked out a global figure that, they suggest, could be relevant to “real-world policy”.

It takes into account the consequences of all human activity, and it embraces detailed outlines of possible low-carbon choices. It also offers, they say, a 66% chance of staying within the internationally-agreed limit.

“We now better understand the carbon budget for keeping global warming below 2°C,” Dr Rogelj says. “This carbon budget is very important to know because it defines how much carbon dioxide we are allowed to release into the atmosphere, ever.

“We have figured out that this budget is at the low end of what studies indicated before, and if we don’t start reducing our emissions immediately, we will blow it in a few decades.” – *Climate News Network*

## Is a Game Changer coming!!!!

### Crispr is Coming to Agriculture, with Big Implications for Food, Farmers, Consumers, and Nature

By Maywa Montenegro, originally published by [Ensia](#) | FEB 17, 2016



*Illustration by Kelsey King*

Very few technologies truly merit the epithet “game changer” — but a new genetic engineering tool known as CRISPR-Cas9 is one of them. Since we first developed the ability to alter the genetic material inside a plant or animal in the 1970s, efforts to do so have required weeks, months or even years of molecular tinkering. With CRISPR (the technology’s shorthand name), precision and speed have soared.

“In the past, it was a student’s entire Ph.D. thesis to change one gene,” Bruce Conklin, a geneticist at the Gladstone Institutes in San Francisco, [recently told \*The New York Times\*](#). “CRISPR just knocked that out of the park.”

The tool is also extremely versatile and seems to work in nearly every creature and cell type in which it has been tried. In [the words of Jill Wildonger](#) of the University of Wisconsin–Madison, “It really opens up the genome of virtually every organism that’s been sequenced to be edited and engineered.”

And that, when it comes to agriculture and the environment, is both its promise and its peril. CRISPR opens the door to all kinds of potential food production improvements. But improvements for whom? Farmers? Consumers? Agribusiness? Sustainable farming systems? Industrial agriculture? And who will decide?

If we want to make sure this powerful technology promotes just and sustainable food, we’ll need to accompany its development with a policy framework that reflects the nuances of its biology and its diverse applications — and that responds to the concerns of people who are affected when technologies migrate from lab to land.

## Game-changing Tool

CRISPR as a gene-editing tool has a [complex origin story](#), with researchers in California and Massachusetts waging a patent war over its innovation, while recent stories tell of independent discoveries at Vilnius University in Lithuania. For our purposes, I'll focus on what happened here at the University of California, Berkeley where in 2011, Jennifer Doudna, a biochemist and molecular biologist, and Emmanuelle Charpentier, a microbiologist now at the Max Planck Institute for Infection Biology in Germany, grew intrigued by the way many bacteria respond to viral invasions. The microbes, it turns out, have an uncanny ability: They store DNA from invading viruses in a sort of genetic library called CRISPR. If the same virus should attack again, the bacteria can use CRISPR to mobilize an enzyme called Cas9 to cut up the intruder's corresponding DNA.

In 2012 Doudna and colleagues realized it would be at least theoretically possible to adapt the CRISPR-Cas9 complex so it could function not just in microbes, but in other organisms too — from fungi to plants to people. And by providing their own “guide,” they could effectively steer Cas9 to cut those organisms' DNA in any spot they wished.

They soon succeeded in developing a programmable version of CRISPR. And reporting in a [2014 \*Science\* paper](#), Doudna and Charpentier sketched the contours of its transformative potential: “These results highlight a new era in which genomic manipulation is no longer a bottleneck to experiments, paving the way toward fundamental discoveries in biology, with applications in all branches of biotechnology, as well as strategies for human therapeutics.”

These diverse applications are made possible by the many types of editing CRISPR enables. CRISPR can make precise mutations by substituting existing DNA sequences with desired ones. It can disable whole genes by snipping them out or via imprecise repairs that knock out gene function. The Cas9 enzyme itself can be manipulated to enhance or suppress gene expression — a powerful way of controlling genes without any editing, per se.

CRISPR can also be used to introduce new genetic material, providing a big boost to an emerging technology known as “gene drive.” Gene drives work by “selfishly” promoting the likelihood of their inheritance, accelerating the spread of a modified gene throughout an entire population ([a great graphic here](#)). Theorized since the 1940s as a technique that might offer unprecedented control over insectborne diseases, gene drives didn't become viable until CRISPR came along. In late 2015, biologists at the University of California, Irvine and the University of California, San Diego reported [the first working version](#) in lab mosquitoes. If released into the wild, such CRISPR-edited insects could offer a way to tackle pernicious global health problems including malaria, dengue fever, sleeping sickness, yellow fever, West Nile virus and Lyme disease. Crop diseases and pests are also now in gene drives' crosshairs.

In sum, shifting CRISPR from its native bacteria into a widely applicable programmable tool was more than a technical coup. As Doudna told *The New York Times*, it was at this moment that “the project went from being ‘This is cool, this is wonky’ to ‘Whoa, this could be transformative.’”

## CRISPR on the Farm

Few will argue against using CRISPR in controlled laboratory environments to induce cancer in T-cell lines for drug development, to build better mouse models, to study what goes on inside plant cells as they fight invasions from bacteria or fungi. But pure science can't be smoothly carved away from real-world applications. How will we deal with prospects for editing the genes of organisms in living environments?

In the realm of agriculture, that's no longer hypothetical.

Since its 2013 demonstration as a genome editing tool in *Arabidopsis* and tobacco — two widely used laboratory plants — CRISPR has been road-tested in crops, including wheat, rice, soybeans, potatoes, sorghum, oranges and tomatoes. By the end of 2014, a flood of research into agricultural uses for CRISPR



included a spectrum of applications, from boosting crop resistance to pests to reducing the toll of livestock diseases.

Chinese scientists, for example, reported **creating a strain of wheat** that is resistant to powdery mildew, a destructive fungal disease. DuPont is currently collaborating with Doudna's company, Caribou Biosciences, to grow corn and wheat strains **edited for drought resistance**, with market prospects slated for 5 to 10 years and field trials set to begin in spring 2016.

Meanwhile, the first commercially available "CRISPRed" crop has already appeared: an oilseed rape created by Cibus, a San Diego-based company. The rape has been altered for herbicide resistance, enabling farmers to spray their crop with weed killer. **According to *Nature***, the company is marketing the product as non-genetically modified, since only a few snippets of the plant's existing genes have been changed and "no gene has been inserted from a different kind of organism, nor even from another plant."

At the Roslin Institute in Scotland, a unique CRISPR experiment is underway in pigs. In sub-Saharan Africa and Eastern Europe, a hemorrhagic virus that causes African swine fever sweeps through pig populations, devastating small farms. Some warthogs, however, seem mostly unaffected by the illness, and a research team led by biotechnologist Bruce Whitelaw believes that a gene called RELA, which varies slightly between wild and domesticated pigs, might account for the immunity difference. Using CRISPR, the researchers have recently tweaked domesticated pig genes to achieve the exact warthog RELA sequence. Trials began last summer exposing modified piglets to the virus to test if they are indeed immune.

Reports suggest that an entire barnyard of edited animals destined for industrial agriculture is rapidly **filling the R&D pipeline**. Recombinetics, a start-up firm, made headlines with hornless dairy cattle carrying a smidgen of genes from naturally smooth-headed beef cows. The company is now working on Brazilian beef cattle with larger muscles (for more meat, which may be more tender), while other firms are developing chickens that only produce female offspring (for egg-laying) and beef cattle that only produce males (for more efficient feed-to-meat conversion).

With respect to gene drives, while agriculture remains at the periphery thus far, researchers at Harvard's Wyss Institute for Biologically Inspired Engineering have **outlined heady prospects**. Gene drives could "pave the way toward sustainable agriculture," they suggest, by reversing pesticide resistance in insects and herbicide resistance in weeds. Drive systems could also destroy or modify pesky plant pests and squelch populations of invasive species, such as rats and kudzu.

## **Improvement — With Concerns**

Both journalists and the scientists they interview have largely framed agricultural uses of CRISPR as an improvement over conventional breeding and conventional genetic engineering alike, because it offers subtlety, speed and a high degree of control over the outcome.

"It's like a find-replace function in the genome of these animals," Scott Fahrenkrug, CEO of Recombinetics, **told *The New York Times***. "You can change even a single base pair, or you can delete a gene very precisely," **Pamela Ronald**, a geneticist at the University of California, Davis explained in *Nature*. The resulting animals and plants could potentially yield more food with less pressure on inputs such as water and land. A CRISPR-tweaked farm system could have a smaller environmental footprint and even humanitarian benefits, if it means farmers don't have to dehorn cattle or cull their male bulls.

But others have questioned the "precision" part of precision breeding. Charles Benbrook of the Center for Sustaining Agriculture and Natural Resources at Washington State University points to the **unexpected effects** when new genes are added or existing ones are silenced. CRISPR is also known for making unintended edits, though the frequency of such "off-target effects" is falling.

And even with the increased precision, there's no guarantee of the desirable outcome. Traits such as drought tolerance not only are associated with many genes, but also are subject to complex environmental

interactions: How much the gene functions will depend on precipitation, heat, the nature and depth of soils, and so forth. Moreover, the genetic background of each individual species or crop will also influence the behavior of genes.

“So in many cases,” says Doug Gurian-Sherman, a plant pathologist and director of sustainable agriculture at the Center for Food Safety, “the particular genes used will only work well in certain genetic backgrounds and environments.” If we want to design agriculture for local ecosystems, suited to the specific soils, climates and cultivation practices of local people, editing is at best a partial solution.

A separate concern — already visible with the pigs snuffling around the Roslin Institute — is lack of an overarching sustainability or justice directive for genomic agricultural science. As *Nature* aptly noted, while Whitelaw’s pig project will largely benefit poor farmers, this is “a rarity for editing research.” A much more common goal in livestock editing has been to generate higher-profit cattle, pigs and sheep — the familiar trappings of industrial food with its concomitant implications for small, sustainable farmers. Whose benefits are being considered when we dream of what CRISPR can do?

Not those of complex ecological systems, it appears. As mentioned above, among the agricultural applications of CRISPR in the research pipeline are those that would alter the biology of insects and weeds — in some cases, editing genes to overcome resistance to pesticides and herbicides. CRISPR-assisted gene drive technology could propel such mutations through populations in the wild, creating the potential to modify entire plant or animal communities over just a few years.

It’s a curious vision of sustainable agriculture, though, that sees overcoming resistance to agrochemicals as progress. Should we really be enabling farmers to spray more glyphosate into their fields when the World Health Organization has found the chemical to be a “probable” carcinogen and when it’s been associated with *collapsing populations of monarch butterflies*? And using gene drives to snuff out wild organisms because they carry diseases or nibble on crops could have serious unintended consequences, such as destabilizing food webs and facilitating invasions by other species.

When it comes to animal engineering, we can appreciate the greenhouse gas–reduction benefits of better feed-to-meat conversion ratios. But is this just making something less bad, rather than good? And is scaled-up livestock production what society should now be chasing at all, given the *environmental* and *public health* upshots of intensive animal farming — not to mention *mounting medical evidence* that people should eat less meat?

### **Consider the Mutation, Consider the Application**

With Big Food rapidly moving to take advantage of this new tool, the *persistent questions that surround genetically modified organisms* are cropping up in new contexts and with new complexities. How will we handle the technology? How should we regulate it? Can CRISPR foster advances for the common good?

I’d argue “yes” — but to ensure benefits outweigh downsides will require a change more revolutionary than any tech breakthrough: an inclusive process for deliberating on and providing adequate societal oversight of risks, trade-offs and opportunity costs of CRISPR engineering. It will hinge on the involvement of everyday people — not just scientists or companies — in decisions about the food system.

Key to making good decisions, first of all, is to understand that not all applications of CRISPR are created equal — or have equal implications for the sustainability of agriculture. Like all breeding and biotech, genomic editing will bring positive and negative consequences, and should be evaluated on a full range of social and environmental effects. Our policies need to treat CRISPR not as a single technology, but as a toolbox full of technologies, each of which is specific to the mutation, organism and ecosystems in question.

In an *article in the New York Times*, for example, journalist Jennifer Kahn, like *many others*, is careful to point out that several companies are using CRISPR to create crops without using genes spliced in from other species, “like a flounder gene inside a tomato.” Here, public perception of CRISPR’s relative safety as



compared to other genetic engineering methods has important policy implications. Flounder inside a tomato screams “GMO,” while genomic editing that does not introduce foreign genes is supposedly very different.

However, for all the attention to precise edits that do not introduce foreign genes, it’s important to understand that CRISPR is **highly adept at that kind of modification too**. Using CRISPR, wheat, corn, pigs, bananas — any agricultural organism, really — could be engineered to include gene sequences from a range of donors: microbes or fungi or fish. “You can easily use CRISPR-Cas9 to edit virtually any genome with your desired donor DNA,” explains Fuguo Jiang, a postdoctoral fellow in Doudna’s lab. “That is the power of gene editing.”

Meanwhile, even many CRISPR edits that don’t intentionally involve genes from other organisms are turning out to include exactly that. The way researchers usually get CRISPR technology working in a plant cell is to use a pest bacterium (*Agrobacterium tumefaciens*) to shuttle in the genes that code for Cas9. As result, bacterial DNA can wind up in the plant genome. Even when *A. tumefaciens* is not used, **according to Nature**, “fragments of the Cas9 gene may themselves be incorporated into the plant’s genome” — moving it into the touchy category of organisms whose genetic material contains foreign DNA.

Of course, scientists are rapidly trying to innovate around that unintended foreign introduction in order to strengthen the claim that CRISPR should not be regulated in the same way as conventional genetic modification. As Huw Jones, a senior research scientist at Rothamsted Research, a U.K. agricultural experiment station, **told Nature**, “If Europe regulates genome-edited organisms in the same way it does GM organisms, it will kill the technology here for all except the biotech companies working with profitable traits in the major crops.”

Scientists have **persuasively argued**, too, that CRISPR offers routes around some of the main causes of GMO concern, including random integration of transgenes — and resulting unintended effects such as disrupted host metabolism, or producing allergenic or toxic compounds.

These arguments do have their merits, yet they are also coming from scientists whose passions and careers are staked in biotechnology and molecular editing. We will need a more inclusive process of deliberative governance, including the many people, in many environments, who’ll be affected by CRISPR, just as we need such a process for other biotechnologies. For example, what are the ecologists saying? What do indigenous peoples want?

### Clarifying “GMO”

To U.S. regulators, most organisms currently under development — Cibus’ oilseed rape, Recombinetics’ hornless cows and Caribou Biosciences’ corn and wheat — may not be considered genetic modification. This is because U.S. policy is product-based, and with many types of CRISPR edits, the product will not include foreign genetic material. In cases where editing introduces sequences **from close crop wild relatives**, the product might even be genetically indistinguishable from the results of conventional crossbreeding — and, say researchers, could even qualify as organic. But the rules are different in Europe, where the term “GMO” is defined not by verifiable characteristics of a product but by the process used to create it. As long as methods of genetic engineering are used somewhere in the production process, then the label would apply.

The European Commission has not yet decided, however, how it will treat genomic editing, including CRISPR. Nor has the U.S. Food and Drug Administration confirmed whether CRISPR animals will be regulated in the future.

If anything, CRISPR helps us see that GMO/non-GMO binaries are overly simplistic. This one tool can perform many DNA nips and tucks and can up-regulate or down-regulate genes in ways that are not transgenic — yet are by no means inconsequential. Many CRISPR edits, I can’t overemphasize, won’t involve any questions about foreign DNA, but will be equally dramatic in their effects. In crops and animals, “gene knockouts” can eliminate genes that affect food quality, divert energy away from valuable end

products, and confer susceptibility to crop diseases. Using the Cas9 enzyme's powerful ability to enhance or suppress gene activity could touch on many important processes of crop and livestock metabolism, resistance and yield.

Many researchers and companies are vying to call all of the above non-transgenic. Some folks have recently gone so far as to say that **GMO is a "metaphor,"** a cultural construct that doesn't map onto anything in the real world, and therefore can't be regulated in any meaningful way. I agree that reaching a single, comprehensive definition of GMOs is elusive. But trying to argue that there are no boundaries hopelessly mingles all sort of genetic modification and processes together so they are all acceptable.

What I hope CRISPR offers instead is an opportunity to better incorporate the full range of biological, cultural and political meanings into our discussions of genetic engineering, and to mark out certain things for closer scrutiny and control — as should be the case in democratic societies, rather than freewheeling markets.

We might envision something modeled on the **IAASTD process**, which between 2005 and 2007 gathered 900 participants from governments, scientific institutions, the private sector *and* civil society to deliberate the same big questions facing CRISPR today: "How can we reduce hunger and poverty, improve rural livelihoods, and facilitate equitable, environmentally, socially and economically sustainable development through the generation, access to, and use of agricultural knowledge, science and technology?"


What we learned from IAASTD (read the **synthesis report** here), is that small farmers, fishers, pastoralists and indigenous communities around the world aren't afraid of biotechnologies. But neither do they see much use for them, given many lower-hanging fruit — such as **agroecology** — for improving the productivity and resilience of farming systems. And when there is fear, it is not the Frankenfood flavor, but the apprehension, as Pope Francis **recently expressed**, that "following the introduction of these crops, productive land is concentrated in the hands of a few owners due to 'the progressive disappearance of small producers, who, as a consequence of the loss of the exploited lands, are obliged to withdraw from direct production [Episcopal Commission for Pastoral Concerns in Argentina, 2005].'" The most vulnerable of these, Francis continues, "become temporary labourers, and many rural workers end up moving to poverty-stricken urban areas. The expansion of these crops has the effect of destroying the complex network of ecosystems, diminishing the diversity of production and affecting regional economies, now and in the future."

Thirty years ago, we didn't understand what the then-new genetics was, or what it might yield. In what scholar Donna Haraway calls the "god-trick," we thought of genetics as the key to scientific mastery of nature, as if there was no context, no agency in the object, no imperfection in human knowledge. Molecular science somehow licensed us to treat genes as separate from ecology and bodies. Now we are fathoming intricate interactions between genes and environments, and ecosystems whose changes aren't smooth or predictable, but that bristle with threshold effects and emergent properties. We've come to appreciate the inseparability of nature and culture in complex systems.

CRISPR is giving us a rare opportunity, then, to escape GMO definitions stuck in the 1980s and begin treating agriculture and food as the complex systems they are. It invites us to update biotech governance to include expertise from a wider public and range of sciences. We'll need to consult not just geneticists but also ecologists. Not just natural scientists but social scientists. Not just scientists, but farmers, consumers, seed producers and workers across the food chain.

In the process, as journalist Brooke Borel **persuasively argues**, we should be alert for conflicts of interest, scrutinizing power structures and considering "who is included in the work and who is excluded or marginalized, whether because of gender or race or any other identity." These factors matter because they shape who has access to the making of science, and who has influence over its aims.

Will we take up the CRISPR challenge? Early developments in applications for agriculture suggest that we could miss this rare chance to foreground sustainability and public deliberation, rather than re-entrenching

an industrial status quo. But if we raise our voices now, early developments could force disruptive, democratic thinking instead. 

*Author's note: A special thanks to Dr. Fuguo Jiang for answering my many CRISPR questions. Any errors in the piece are my own, not those of the reporters and researchers whose work I have learned from.*

## Marine mining: Underwater gold rush sparks fears of ocean catastrophe

This article is from The Guardian

<http://www.theguardian.com/environment/2014/mar/02/underwater-gold-rush-marine-mining-fears-ocean-threat>

This is the last frontier: the ocean floor, 4,000 metres beneath the waters of the central Pacific, where mining companies are now exploring for the rich deposits of ores needed to keep industry humming and smartphones switched on.

The prospect of a race to the bottom of the ocean – a 21st-century high seas version of the Klondike gold rush – has alarmed scientists. The oceans, which make up 45% of the world's surface, are already degraded by overfishing, industrial waste, plastic debris and climate change, which is altering their chemistry. Now comes a new extractive industry – and scientists say governments are not prepared.

"It's like a land grab," said Sylvia Earle, an oceanographer and explorer-in-residence for *National Geographic*. "It's a handful of individuals who are giving away or letting disproportionate special interests have access to large parts of the planet that just happen to be under water."

The vast expanses of the central Pacific seabed being opened up for mining are still largely an unknown, she said. "What are we sacrificing by looking at the deep sea with dollar signs on the few tangible materials that we know are there? We haven't begun to truly explore the ocean before we have started aiming to exploit it."

But the warnings may arrive too late. The price of metals is rising. The ore content of the nodules of copper, manganese, cobalt and rare earths strewn across the ocean floor promise to be 10 times greater than the richest seams on land, making the cost of their retrieval from the extreme depths more attractive to companies.

Mining the ocean floor of the central Pacific on a commercial scale is five years away, but the beginnings of an underwater gold rush are under way. The number of companies seeking to mine beneath international waters has tripled in the last three or four years. "We have already got a gold rush, in a way," said Michael Lodge, deputy secretary general of the [International Seabed Authority](#), which regulates the use of the sea floor in international waters. "The amount of activity has expanded exponentially."

The Jamaica-based agency has granted 26 permits to date to explore an area the size of Mexico beneath the central Pacific that had been set aside for seabed mining – all but eight within the last three or four years.

[Britain is leading the way](#) in a project led by Lockheed Martin, but Russia, China, Japan, and South Korea all have projects in play. This year alone, companies from Brazil, Germany and the Cook Islands have obtained permits to explore tracts of up to 75,000 sq km on the ocean floor for copper, cobalt, nickel and manganese, and the rare earth metals that help power smartphones, tablets and other devices.

Other areas of the Pacific – outside international waters – are also opening up for mining. [Papua New Guinea has granted permission](#) to a Canadian firm, Nautilus Minerals, to explore a site 30km off its coast for copper, zinc and gold deposit worth potentially hundreds of millions of dollars.

Lodge expects the pace to continue, with rising demand for metals for emerging economies, and for technologies such as hybrid cars and smart phones. Extracting the metals will not require drilling. The ore deposits are in nodules strewn across the rolling plains of sediment that carpet the ocean floor. Oceanographers say they resemble knobbly black potatoes, ranging in size from a couple of centimetres to 30cm. [Mining](#) companies say it may be possible to scoop them up with giant tongs and then siphon them up to vessels waiting on the surface.

The problem is much remains unknown – not just about what exists on the ocean floor but how ocean systems operate to keep the planet habitable. The ocean floor was once thought to be a marine desert, but oceanographers say the sediment is rich in marine life, with thousands of species of invertebrates at a single site.

"It's tampering with ecosystems we hardly understand that are really at the frontier of our knowledge base," said Greg Stone, vice-president for [Conservation](#) International. "We are starting mining extracting operations in a place where we don't fully understand how it works yet. So that is our concern – disturbing the deep sea habitat."

Most of the models rely on being able to produce 1 million tonnes of ore a year. Stone said the seabed authority was putting systems in place to protect the ocean floor, but other scientists said there still remained enormous risks to the sediment and the creatures that live there.

"It is going to damage vast areas of the sea floor," said Craig Smith, an oceanographer at the University of Hawaii who served as an adviser to the International Seabed Authority. "I just don't see any way [in] mining one of these claims that whole areas won't be heavily damaged."

Earle expressed fears about how mining companies will deal with waste in the high seas. "Mining is possible," she said. "But the 20,000ft question is what do you do with the tailings? All of the proposals involved dumping the tailings at sea with profound impacts on the water column and the sea floor below. The Seabed Authority initially proposed to set aside 1.6m sq km of the ocean floor as protected areas, or about 20% of its territory. But those reserves are under review. As economic pressures rise, there are fears that commercial operations would begin to erode those protected areas.

"I think it is certain that within a year or two there will be more claims covering these areas and there won't be enough room left to develop these scientifically defensible protected areas," Smith said.

Some have argued that with all the unknowns there should be no mining at all – and that the high seas should remain out of bounds for mineral extraction and for shipping.

José María Figueres, a former president of Costa Rica and co-chair with the former British foreign secretary, David Miliband, of the [Global Ocean Commission](#), an independent entity charged with developing ideas for ocean reform, suggested leaving all of the high seas as a no-go area for commercial exploitation (apart from shipping).

"Do we know enough about the seabed to go ahead and mine it?" said Figueres. "Do we understand enough about the interconnection between the seabed, the column of water, the 50% of the oxygen that the ocean produces for the world, the 25% of the carbon that it fixes in order to go in and disrupt the seabed in way that we would if we went in and started mining? I don't think so, not until we have scientific backing to determine whether this is something good or bad for the planet."

World leaders are now mobilising to address concerns, not just about seabed mining, but about how to safeguard ocean systems which are increasingly recognised as critical to global food security and a healthy planet.

[US secretary of state John Kerry, in a video address](#) delivered to a high-level ocean summit hosted by the *Economist* and *National Geographic* last week, invited leaders to a two-day summit in Washington that will seek ways of protecting fishing stocks from overexploitation and protecting the ocean from industrial pollution, plastic debris and the ravages of climate change.

The stakes have never been higher, scientists said. The oceans are becoming increasingly important to global food security. Each year more than a million commercial fishing vessels extract more than 80m metric tonnes of fish and seafood from the ocean. Up to three billion people rely on the sea for a large share of their protein, especially in the developing world.

Those demands are only projected to grow. "If you look at where food security has to go between now and 2030 we have to start looking at the ocean. We have to start looking at the proteins coming from the sea," said Valerie Hickey, an environmental scientist at the World Bank.

That makes it all the more crucial to crack down on illegal and unregulated fishing, which is sabotaging efforts to build sustainable seafood industries. Two-thirds of the fish taken on the high seas are from stocks that are already dangerously depleted – far more so than in those parts of the ocean that lie within 200 miles of the shore and are under direct national control.

Estimates of the unreported and illegal catch on the high seas range between \$10bn and \$24bn a year, overwhelming government efforts to track or apprehend the illegal fishing boats. The illegal fishing also hurts responsible fishing crews.

Figueres and Miliband suggested fitting all the vessels operating on the high seas with transponders to track their movements. That would single out rogue fishing vessels, making it easier for authorities to apprehend the vessels and their catch. It's not a perfect solution. A diplomat who has negotiated international agreements to control illegal fishing said captains – already cagey about revealing their favourite fishing routes – would simply flip off the transponders.

United Nations officials were also sceptical of the idea of a high-seas police force. "It sounds a little bit like science fiction for me at this particular moment," said Irina Bokova, the director general of [Unesco, which manages 46 marine sites](#). "What kind of police? Who is going to monitor? How is it founded? It's a very complicated issue."

But the debate was a sign of growing momentum in an international effort to protect the oceans – before it's too late.

When it comes to the ocean floor, that process is at the very early stages. But given the multiple disasters humans have made with the ocean so far, the stakes are high for getting it right.

"There is no doubt there are huge mineral resources to be extracted at some point in the future," Lodge said. "It's also true we don't know enough about the impact on biodiversity and the impact on marine life once the mining takes place."

As the ultimate custodian, said Michael Lodge, the International Seabed Authority had two responsibilities; making sure companies access that vast mineral wealth in an environmentally responsible way, and then sharing it out equitably. "We have a huge challenge to devise a fiscal regime so that humankind as a whole gets a fair share. That's an enormous challenge, he said. "If we end up giving it away to industry, then we have failed in our missions."

And the costs of such a failure are already becoming painfully evident in the greater ocean.

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## Project Catalyst a 'game changer' for cane growers ready to embrace change

**ABC Rural**

By [Charlie McKillop](#)

Cane growers have been meeting in Cairns to reflect on some of the success stories of Project Catalyst.



Now in its eight year, the unique collaboration between the sugar industry, natural resource management groups, World Wildlife Fund and the Coca Cola Foundation has resulted in dozens of innovations and ideas being trialled on farms across Queensland.

Collectively, growers have led the way in reducing run-off, cutting nitrogen use, saving water, boosting soil health and adopting farming practices that have resulted in improving the quality of more than 150 billion litres of water flowing to the Great Barrier Reef.

Terrain Natural Resource Management chief executive Carole Sweatman hosted the forum and said Project Catalyst was moving beyond being a powerful network of like-minded growers to agents of change for the industry.

"For every Catalyst grower, we've got at least another five or six growers in the wet tropics area, for example, who are trialling different things that don't necessarily fall into this category but nevertheless is innovative," she said.

"So that, to me, is a real sign that this is just starting to really build the story about how many people are out there doing great, new things."

*Better that we regulate ourselves than have other people regulate us so it's just a natural progression in the business. If we're going to stay here, we have to improve and conform.* Stephen Accornero, Herbert River cane grower

The State Government has said it was running out of patience with industry's willingness to regulate itself, with just a third of Queensland's cane growers taking up best management practices (BMP).

Ms Sweatman said Project Catalyst was showing what's possible when industry 'gets on the front foot'.

"I do know we have to change a bit faster and that is a big challenge for people," she said.

"There's concern about what may or may not work, there's risks to livelihoods... but what we really want is farmer-led change and farmer-led innovation."

## **Corn crop better for bottom line**

Stephen Accornero is among almost 80 growers who have been prepared to take an unconventional approach.

He extended the fallow period on his farm in the Herbert River district, near Ingham, by rotating beans and corn with his cane crop. He said the change had paid dividends for his soil health, productivity and bottom line.

"We've had better cane crops after it so much so at times we had difficulty finding poorer crops to plough out in that area," Mr Accornero said. "If we're going to stay here, we have to improve and conform

"You've been averaging roughly about 100 tonnes a hectare for the past four or five years consistently and that's across the board."

Mr Accornero admitted he may not yet have completed his BMP accreditation but he said it was a work-in-progress.

"Better that we regulate ourselves than have other people regulate us so it's just a natural progression in the business," he said.

"If we're going to stay here, we have to improve and conform."



# Growing Organic Food is it time for us to change????

## LOOK WHAT IS HAPPENING IN THE USA

From the Resilience Newsletter

I attended the annual conference of the Ohio Ecological Food And Farm Association recently and as usual it really lifted my spirits. We are so barraged by doom and gloom these days as presidential candidates yell insults at each other, that we tend to over-emphasize the bad news and ignore the good news. In farming, mainstream agriculture is mostly full of bad news right now, but although I sympathize with the farmers caught in the jaws of a declining industrial agriculture, that is sort of good news to me. For instance a report just out says that a huge corn-ethanol plant in Kansas is declaring bankruptcy and leaving millions of dollars it owes grain companies unpaid. That's bad news but good news in the sense that farmers just might start to realize what a bad idea it is to grow corn for ethanol especially on hills and prairies where annual cultivation is very destructive. Ironically, the farm paper, *Farm and Dairy*, recently quoted Monte Shaw, head of the Iowa Renewable Fuels Association, saying that even though Iowa has the highest production of ethanol from corn (3.8 billion gallons per year) "we still have excess corn." Think of how tragic that is and yet how it might bring some sanity back into commercial farming.

But all I heard at the OEFFA conference was good news, even jubilant news as the pioneers of a new kind of farming march forward into a future we have no name for yet. One dairyman told me it was "just embarrassing how much money I'm making right now." He is a certified organic milk producer on a small farm with a relatively small herd, his land planted mostly to grass and clover, growing the grain he needs for his cows, not having to buy outside organic grain which is selling around \$10 to \$12 a bushel.

In fact the organic farming news is so good even big agribusiness companies like Cargill are reportedly getting into it. Some organic farmers and their organizations are worried that the demand and high prices will mean overproduction. In his speech, John Bobbe, director for Organic Farmers' Agency for Relationship Marketing, worried that the high demand for organic food has conventional farmers "considering organic for the wrong reasons." It could mean a collapse in organic prices similar to the one in 2008, he said. Right now, a large quantity of organic grain is being imported. Tim Boortz of NForganics was even more pointed in his talk at the conference. "You can't go into organics because of price. You have to believe in the institution of it." I know that's true from personally observing some years ago several eager beavers who "went organic" only because they thought they could make big bucks. They soon got out of it. Organic farming requires long-term, idealistic steadfastness.

Michael Kline, who works for Organic Valley, one of the larger milk marketers, was particularly upbeat. Right now there is more demand for organic dairy products than Organic Valley can supply, he told me, and the number of farmers transitioning into organic production is increasing dramatically. I know one very good reason for this. Organic Valley's butter is the best I have ever tasted. Carol, my wife, who is much more discerning about such matters, agrees. It is not available in any of our local stores, which is an example of the challenge Organic Valley is trying to cope with. It can't keep up with demand.

I asked Michael about the possible dilemma on the horizon of glutting the organic market. Aha, Organic Valley has thought of that already and has built in controls in its contracts with farmers to counter that situation should it arise. It is too complicated to detail here and I wasn't taking notes, but I plan to get with Michael in the future and spell it out here because overproduction has always been agriculture's biggest challenge.

What is so striking to me about OEFFA members is the wide disparity in their backgrounds. As I sat there signing books, I was approached by a doctor who grows open pollinated corn. Another man whose main profession I forgot to ask about, wanted to talk about religion even more than he wanted to talk about

farming. A retired philosophy professor plopped a whole box of my books on the table for me to sign. A young farmer described how he grows sorghum and sells the syrup as one of his main crops. A farm wife told me her other job was doing design work for a magazine. A food gardener who said he was an animist, wondered if, from my writing, I was too. Several young couples were very excited about getting into small scale, artisanal farming like cheese making and growing salad greens in hoop houses. The only farmers that I didn't see were the "real" ones who raise thousands of acres of corn and soybeans. When one of them shows up at my table, I'll know for sure that a new era of farming is on the way.

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## Joel Salatin: Communicating Ecological Eating

February 1, 2016 in [Eco-Living & Health](#), [Farm Management](#), [Opinion](#)

*This article first appeared in the February 2016 issue of Acres U.S.A.*

**Six Key Messages for Consumer Outreach** - by Joel Salatin



As farmers, we enjoy conversations about soil, water, animal husbandry, horticulture and every other kind of production nuance. That's as it should be. But all of this production is meaningless without someone to use it.

Obviously the industrial food system has a lot of users. Whether those users are lazy, ignorant, evil or just plain unconscious is anybody's guess. But if we're ever going to get ecological farming more widely practiced, we obviously need more ecological eaters.

How do we move ecological farming forward fastest? Is it by converting farmers, or converting people who buy our stuff? Certainly both need attention, but I'll submit that we don't put enough responsibility on customers. While we farmers shoulder the brunt of accusations regarding depleted soils, tasteless food, animal abuse and pathogen-laden fare, by and large consumers escape with excuses.

Part of our marketing as ecological farmers, both corporately and individually, is to put some onus on our constituency to drive demand for a different farming paradigm. Farmers and the food system have always risen to market demand. Letting our customers off the hook as just victims of advertising is an excuse that doesn't serve our soil well.

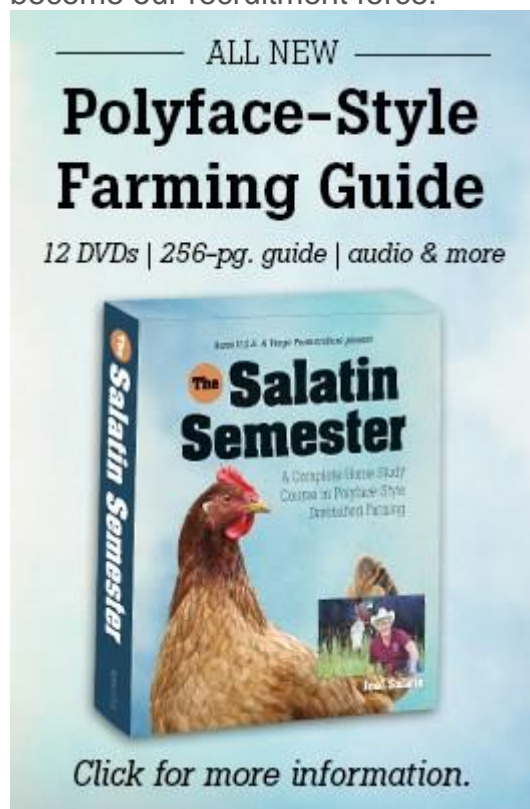
Those of us who understand the problems and the solutions need to articulate this responsibility on our advertising fliers, to our farm visitors, and in our collective voice. Factory farming exists because people buy factory-farmed stuff. Hot Pockets exist because people buy them. Genetically Modified Organisms (GMOs) exist because people buy them.

I'm tired of urban folks looking into a camera and saying they can't find an alternative to the supermarket. I'm tired of fast-food outfits saying they can't find enough ecological food. I recently fielded a set of questions from a representative for four nearby universities who wanted to buy

non-industrial food but said it could never be produced in enough quantity. Suddenly these big buyers have a caveat for their student agitators: “We can’t find enough.”

I have news for these folks: “If you really mean business, we’ll produce it. But you won’t come out of your fraternity and talk to us.” Thousands of ecological farmers are able and willing to double their production. Thousands more are waiting in the wings to join us. The weak link is market desire. For ecological farming to thrive, we need a cultural shift to ecological eating.

Here are some protocols for ecological eating that offer positive messaging to our customers and buyers as a whole. Rather than browbeating them for being naive, lazy, ignorant or whatever else we can rant about, let’s give our customers the language to join us as team players and then to become our recruitment force.



### 1. SAFE.

This may seem like a no-brainer, but our side too often plays defense on this issue. Let’s take the offense. Let’s start with some soft questions — almost rhetorical for their simplicity.

Do you feel safer in a crowd or at home?

Do you trust your neighbor more than a foreigner? (This has nothing to do with xenophobia. It’s just a straight-up intuitive question, without malice or prejudice.)

Do you trust what you know more than what you don’t know?

Do you trust friends more than bureaucrats?

I won’t belabor the questions, but you get the drift.

Ultimately, safer food comes from smaller establishments that we know operated by neighbors and friends. That’s not some crazy leap of faith; it’s as reasonable as it is intuitive. Sure, we can go into the empirical numbers, showing that pathogenic food by and large comes from the largest processors shipped the farthest operated by corporations in

bed with regulatory bureaucracies. But as soon as we head down that path, the other side jumps on unfair statistics. Our side is too small for comparison. Our side is under-reported.

**Upton Sinclair is attributed with first noting that it’s awfully hard for a person to see something when his paycheck depends on believing something else.**

Ultimately, all arguments are won or lost at the heart level. Emotion always trumps science because our ears hear and eyes see only what our paradigm (emotions) allow us to see. Upton Sinclair is attributed with first noting that it’s awfully hard for a person to see something when his paycheck depends on believing something else.

The industrial food system and its lackeys in the USDA and FDA, along with medical and pharmaceutical orthodoxy, have demonized compost, home kitchens, raw milk and pastured livestock long enough. To be sure, some of the most unsanitary production I’ve seen is on small farms purporting ecological and pasture-based protocols. But even those pale in actual food safety infractions compared to the track record of the industrial counterpart.

Anyone with a lick of wisdom exhorts parents to know where their children are and who they’re with. Would any mom send her 5-year-old to a sleepover with strangers? Is it too much to ask that same mom to exercise as much precaution over the food that her 5-year-old ingests?

Would anybody excuse a mom for not checking out the aforementioned sleepover host family because she “just didn’t have time?” Or “I just don’t know what I’m looking for.” Of course not. And yet people use these excuses all the time to justify patronizing the industrial food system. In any other area of life, we’d scream: “Why didn’t you check it out?” But with food, somehow, faith in the supermarket trumps all improprieties.

So far, we’ve only addressed pathogenicity in this food safety discussion. We haven’t even addressed nutritional deficiency, long-term chemical residue effects, or local economies. That’s another whole level of responsibility under the broad heading of safe, but no less important and no less potent. Rather than apologizing for compost and small-scale, localized systems, we need to be the side titled “safe” and push customers to tell us why friends, neighbors, homes and pronounceable labels are less safe than industrial counterparts.

This is why we ecological farmers love Sally Fallon and the [Weston A. Price Foundation](#) (WAPF). This is not an organization of farmers. It’s an organization of no-nonsense truth-seeking moms, for the most part, who dare to defend their families in the food arena. Probably no group has done more to promote an ecological farming agenda and brought more unsolicited customers to good farmers, than WAPF. Thank you.

## 2. SUITABLE.

Ecological eaters realize that the production, and by extension, their menus, need to suit the environmental nest. This speaks to carrying capacity, waste streams, collateral damage and externalized costs.



Recently I’ve been quite chagrined with all the predictions about ocean fisheries failing. Several years ago, I decided, as a matter of personal choice, to quit eating seafood unless I was near the ocean. Who needs salmon in Denver? Clam chowder in Kansas City? I’m naming these two because I dearly love both of them — anytime, anywhere.

But sometimes you just have to ask the question: “Does this fit here?” It’s a simple question with broad ramifications. So when I’m in New England, I eat cranberries whenever I can. But I don’t buy them at our local Kroger. They’re there, and available. They’re not even very expensive. Food writer guru Michael Pollan often says that most Americans eat thoughtlessly.

Just imagine if this kind of thinking entered the majority how it would change buying habits, food chains, distribution networks and advertising. Lest anyone call me a food tyrant, I have my own hypocrisies. My family knows I’m a banana-*holic*. I love citrus. But I have an excuse: for the first four years of my life, our family farmed in Venezuela, near the equator. We had papaya, pineapples, bananas, in the yard, all we wanted. Give me a break.



Festive food and indulgences are all part of a varied and cosmopolitan food culture. But what's the staple in our diets? Two years ago while doing some seminars in Spain I stepped out of my upscale villa, paid for by my upscale hosts, for a breath of fresh air. To my utter astonishment, in walked an American tourist family carrying bags of McDonald's under their arms. Really? This suitability idea goes far beyond regional production capabilities. Does the food fit the ecology?

In our region of Virginia's Shenandoah Valley, we're known as the turkey and chicken capital of the mid-Atlantic region. Not because we produce grain. Not because we have more people eating poultry.

It developed largely because of a poultry entrepreneur named Wampler who figured out how to grow turkeys in confinement houses. Today, our area imports trainloads of grain to feed the poultry industry. Meanwhile, the grain production areas are deprived of the manure that would grow sustainable crops.

And all that manure is turning the valley into a septic tank. With our karst geology, commonly known as Swiss cheese limestone (lots of caverns), all that excess manure pollutes groundwater and streams. So, dear eater, does the food on your plate fit the ecology in which it was grown, or is it an invasive system? An abusive system? A toxic system?

Does it suit, or fit, the landscape? Or is it an eyesore, nose sore wound on the ecology? Asking if it suits sets up a domino effect of accountability. When more people realize that what they see plopped on their plate ultimately creates what they see plopped on the landscape, they'll start deciding more consciously who to patronize with their food dollars. That would be a good thing. In your farm fliers, your interactions with customers, your interviews with the media, look folks in the eye and ask: "Does it suit?" That's not an easy question to answer, but the struggle yields "aha!" moments that garner more loyalty to the road currently less traveled. And that can make all the difference.

### **3. SEASONAL.**

Ecological eaters understand the seasons. Allan Nation, editor of *Stockman Grass Farmer*, tells the story about a *New York Times* food writer asking him for a lead to a New York farm where he could buy a fresh, grass-finished steak.

"What day is it?" Allan asked.

"February 20," the journalist replied.

"What do you see outside your window?"

"Three feet of snow."

"Any grass?"

"No." Pregnant pause. "Oh, I never thought about that," said the contrite journalist.

Eating ecologically means embracing seasonal ebbs and flows. This is why I have such an ongoing dislike of supermarkets. More than anything else, they have created the illusion of human independence. People routinely ask me how they can know that the beef, or pork, or chicken, or lettuce, or whatever in the supermarket is the real deal. I frustrate them to no end with my standard response: "Don't buy at the supermarket."

And as an aside, that means I'm not interested in getting my stuff in the supermarket. I was in a good-sized food co-op the other day and the general manager confessed to me: "Kroger's organic section is kicking our tails." Some see this as progress; I don't. I see it as a new level of ignorance, aimed squarely at my constituency.

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Instead of buying bulk grass-finished beef when it's available, or bushels of tomatoes in September, the supermarket organic section sucks away my constituency to buy imported Mexican tomatoes in January and New Zealand beef. With favored-nation status and maritime distribution concessions, it's cheaper to ship a pound of beef from New Zealand than it is for me to put it on a truck and send it 20 miles in America.

What's wrong with waiting for that first tomato in May? What's wrong with waiting for the flush of egg laying that accompanies spring in the northern hemisphere? Buying in season, buying during the flush of production, stockpiling a domestic larder for off-season menus — this is the stuff of normal food flow. This kind of mentality adds huge market potential for ecological farmers.

Canning, fermenting, freezing, dehydrating, curing and other culinary practices all developed throughout human history to answer the seasonality reality. These practices are as relevant today as they've ever been and can fill in the gaps to create year-round abundance.

Here's the bottom line: our ecological farmers are subject to seasonality. In fact, factory farms are the antithesis of seasonality. That's easy to see. If we're on the same team, dear eater, then you'll join me in eating seasonally, riding my ebbs and flows from the field to the plate. That's eating responsibly and thoughtfully. Anything else is both thoughtless and arrogant, and I'm sure no self-respecting eater wants to be thoughtless and arrogant.

#### **4. SIMPLE.**

Few things define the current debauchery of the American food system like the additive/stabilizing/processing industry. While factory farms certainly have their place in the anti-ecological category, the unpronounceable ingredient and laboratory-chemical manipulation system deserve equal billing.

Although I don't advocate supermarket shopping in general, I do agree that Michael Pollan captures the essence of the simple concept when he suggests that if you're going to shop there, stay on the outside aisles. That's where the raw, unprocessed things are. If we take that advice one step further, we move clear outside the supermarket and buy food that is in its natural, unaltered state directly from farmers. That means chicken with bones in it. Apples with a skin. Potatoes with peels. Eggs with a shell. Milk with cream on top.

In his iconic book *Fast Food Nation*, Eric Schlosser connected the dots between highly processed convenience food available at fast-food restaurants and the high mono-cropped, wasteful, single-trait dependent farm system America has developed. The farming landscape did not develop in a vacuum. The market that changed the farmscape developed when simple food quit appearing in America's kitchens.

From potato chips to breakfast cereals to frozen microwavable dinners, highly processed foods absolutely and inevitably changed the production-scape into an ecologically devastating system. Cookie-cutter genetics, lack of diversity and chemical shortcut fertilization spread across the farmscape like a cancer.

The quickest and probably easiest way to change that is to bring whole, raw, unprocessed foods back into our kitchens. I confess that as direct market farmers, this creates a tension for us when customers happily pay \$10 a quart for chicken stock that should be a natural outgrowth of domestic culinary arts. Must all of us local food providers be required to eventually install commercial kitchens so our vegetables, meat and poultry can be delivered via heat-and-eat convenience?



In the final analysis, preparing, processing, packaging and preserving must be returned to their rightful dominant place — the domestic kitchen. We simply can't have a mass exodus from *homecentricity* and preserve any nuance of integrity within the food system.

I've decided that the most identifying characteristic of an ecological eater is leftovers. The entire food system is moving toward single-serving, ready-to-eat consumables so we can graze individually across our food landscape without ever having to dine communally or prepare from scratch. Goodness, many folks today think that scratch cooking means you have to open a can — we've parsed the nuances of convenience to that extent. Is this crazy?

In the final analysis, preparing, processing, packaging and preserving must be returned to their rightful dominant place — the domestic kitchen. We simply can't have a mass exodus from *homecentricity* and preserve any nuance of integrity within the food system. Eaters must embrace this responsibility, entering and leveraging our kitchens as a badge of honor, the most valuable and important part of our homes.

When food enters the home simply, it insures a participatory component on the part of eaters. It also insures that farmers receive the lion's share of the food value. That, in turn, channels food dollars directly onto farms rather than into the coffers of industrial processors who exhibit dubious ethics. In this way, buying simply becomes not a burden, but a joy to the ecological eater.

## **5. SYMBIOTIC.**

Food worth eating comes from farms that exhibit complex and intricate multi-speciated relationships. That's the way nature works, and good farming practice should mirror that kind of symbiosis and synergy.

Ecological eaters need to understand that their food, during its growing, living time, was not just an isolated thing, but highly integrated into a biological nest. The contrast between eggs coming from a sophisticated factory farm and those coming from a pastured operation, for example, is quite profound. The factory eggs are segregated from any kind of living environment. In addition, the feed and waste streams do not enhance the nest in which the factory farm sits.

Ecological eaters need to understand that their food, during its growing, living time, was not just an isolated thing, but highly integrated into a biological nest.

Rather, the isolated single-species and single-product model reduces symbiotic gains in situ. On our farm, in contrast, the chickens follow the cows in a synergistic choreography. The cows poop, which attracts flies, which lay eggs, which hatch into larvae (maggots). The chickens come along a couple of days after the cattle vacate the paddock, scratch through the cow pies, spreading them over and into the soil for better fertility capture, all as a part of finding and eating the maggots. In addition, the chickens eat newly-exposed grasshoppers and crickets in the freshly-grazed pasture, turning all that nutrition into eggs.

The chicken manure falls directly onto the pastures, where it offers a different blend of fertility than would otherwise be available from an herbivore-only production model. And nobody has to haul the manure away. Ecological food comes from these kinds of intricate relationships, and eaters therefore need to patronize farms that exhibit these principles.

The question an ecological eater should ask is this: "How many beings, both plant and animal, did the parents of this food on my plate dance with during its life?" That's not a silly question. It speaks to the heart, the essence, of eating ecologically.

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## **6. SEAMLESS.**

When you chart the route of the food on your plate to your house, what does that path look like? The more direct the better. I call this seamless eating, and it’s a fairly easy way to capture the mechanics of ecological eating.

Transportation, distribution, warehousing — these tell a tale of energy use, freshness and ultimately genetic selection. For many years now, tomatoes have not been selected for nutritional superiority, taste, or culinary performance. They’ve been selected for the ability to ride in a jostling tractor trailer for a few thousand miles without turning into pulp. Indeed, their cardboard characteristics are quite obvious in both taste and texture. Yuck.

If energy costs escalate, the convoluted paths of food distribution will become obvious for what they are: energy intensive. The shorter the path between field and fork, the more direct it is, the easier to accomplish environmental accountability. That said, I’d be unfair to acknowledge that too often in today’s local food movement this direct path is still more energy costly than the indirect non-local path.

But this is primarily a symptom of economies of scale, not inherent inefficiencies. When Jolly Green Giant transports a tractor-trailer load of green beans 2,000 miles, the energy cost per pound is actually less than on the bushel in the trunk of a car transported 30 miles to a farmers’ market. But that is simply a factor of scale.

If and when more people begin eating seamlessly and local, direct-sourced volumes will increase and enjoy the same kind of scale economies currently enjoyed by the industrial system. And with the advent of electronic aggregation, collaborative marketing and urban drop points, the local food system is fast gaining ground on this weak link.

Localization offers a seamless option that ensures not only accountability, but ultimate community-based food security. Historically, regions dependent on food imports have always been vulnerable to environmental, social, political and integrity breaches. Bioregional food security carries ramifications beyond a warm fuzzy feel-good emotion. It’s survival. That’s kind of a good ecological idea.

These six principles, I submit, should be understood and endorsed by anyone purporting to be an ecological eater. Absent these, I’d call the person an imposter, a poser. Let’s be honest about the ethics and responsibilities of our movement and enjoin the eaters — not just the farmers — to appreciate the protocols of ecological eating. In doing so, we ultimately gain a more knowledgeable and loyal constituency. In church parlance, we gain a choir.

And if we’re ever going to see our movement capture the imaginations and hearts of more people, we need a bigger, louder, more passionate choir. Being honest about their need to show up for practice, to participate, and to understand their songs should not offend; it should encourage better performance and better ministry. We desperately need more ecological eaters. Now go teach them.

*Joel Salatin operates Polyface Farms in Virginia’s Shenandoah Valley with his family. He is the author of several books on ecological, family-scale farming, including Pastured Poultry Profits and Fields of Farmers, all available from the Acres U.S.A. bookstore at [www.acresusa.com/salatin](http://www.acresusa.com/salatin). Polyface holds two-day on-farm “intensive discovery seminars” each summer, offering an invaluable hands-on learning opportunity for attendees. Contact Acres U.S.A. for information or visit [www.acresusa.com/events](http://www.acresusa.com/events).*

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