Secrets of your veggie patch:

What does science say?

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And the Urban Ag. Scientist

"Foundation Building"

What we will cover

1. Introduction to the research & the Edible Gardens Project
2. What we have collected
3. What we have learnt
4. How can people use this knowledge?

Urban agriculture is any form of food production (including keeping urban livestock) occurring within the boundaries or outskirts of urban areas.

It is not defined by:

Size of production Type of crops Intended use of the food

Placement in urban landscape
(indoor, outside, rooftops or vertical spaces)

In our vision of a sustainable future, urban agriculture is widely perceived as scalable approach to improving urban food security.

Yet we still do not know enough about all the different ways people grow food…

Even though home gardens are the most prevalent form of urban food gardens[1,2,3], they remain severely understudied[2,4,5].

Challenges of studying home gardens

- **Huge diversity**
- **Wide geographic spread**
- **Low physical accessibility**

1. Butterfield (2019); 2. Taylor & Lovell (2013); 3. Wise (2014); 4. Pourias et al. (2015); 5. Ward, et al (2014).

Even though home gardens are the most prevalent form of urban food gardens[1,2,3], they remain severely understudied[2,4,5].

CITIZEN SCIENCE

"Public participation in organised research efforts" – Louv et al. 2012[6]

And is an effective approach to help us overcome these challenges[7,8,9]

1. Butterfield (2019); 2. Taylor & Lovell (2013); 3. Wise (2014); 4. Pourias et al. (2015); 5. Ward, et al (2014); 6. Louv et al. (2012); 7. Gittleman et al. (2012); 8. Pollard et al. (2017); Conk & Porter (2016)

Introducing the ***Edible Gardens*** project (2016-18)

Edible Gardens

Purpose: To learn more about the productivity, resource efficiency and social value of urban agriculture in South Australia

Methods

Phase 1 – Online social survey (very detailed)
(more than 400 responses from gardeners aged 18 to 81+)

Phase 2 – In-field garden data collection
(although 70 gardens were registered, 36 were persistent in their data collection)

Discovery Circle

University of South Australia

The Edible Gardens project was open to all food gardens in SA:

HOME

- High survey interest
- High garden data collection interest
- 34 home gardens (with over 90 garden areas) collected data

COMMUNITY

- Some survey interest
- Low garden data collection interest
- 0 community gardens collected data

SCHOOL

- Some survey interest
- Some garden data collection interest
- 2 schools collected data

Edible Gardens Project | DATA COLLECTION TOOLKIT

Welcome to Phase 2 of the Edible Gardens Project!

You will be measuring and recording 5 things:

1. Time spent on your food producing area/s (**minutes**)
2. Money spent on your food producing area/s (**dollars**)
3. Water used by your food producing area/s (**litres**)
4. Weight of the produce you harvest from your growing area/s (**kilograms**)
5. Any produce you share or give away to others (**kilograms**)

It may sounds simple, but… just designing the data collection toolkits took months to get right!

Urban food gardens are complex systems.
Water remains the most difficult input to measure

Water Sources

1. Mains
2. Rainwater*
3. Recycled / blended
4. Greywater
5. Other

Irrigation Methods

1. Manual
2. Drip irrigation
3. Sprinkler
4. Wicking beds
5. Animal water
6. Other

This is one possible toolkit.
We posted out more than 70!

What we have collected:

Our data treasure

Motivations are key

Home Gardener Motivations (n = 369)					
	WHY DID YOU ORIGINALLY START GROWING FOOD?	%		WHY ARE YOU CURRENTLY GROWING FOOD?	%
1	Produce related (mostly taste & freshness)	44%	1	Produce related (mostly taste & freshness)	70%
2	Enjoyment	35%	2	Health (Mostly chemical input concerns and organic food)	47%
3	Health (Mostly chemical input concerns and organic food)	32%	3	Enjoyment	46%
4	Natural connection	21%	4	To save money	27%
5	To save money	18%	5	Natural connection	25%
6	Tradition*	15%	6	Convenience*	21%
7	Connection to others (mostly family)	14%	7	Satisfaction & accomplishment	21%
8	Satisfaction & accomplishment	14%	8	Environmental consideration*	18%
9	Knowledge building	14%	9	Connection to others (mostly family)	17%
10	Convenience*	13%	10	Knowledge building	17%
Average length of food growing experience: 11+ years (43%) and then 1-5 years (30%).					

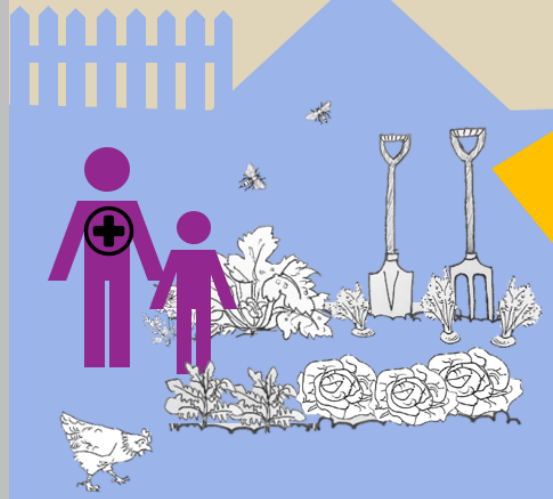
The key difference in top motivations of community gardeners was:

2	Connection to others (community interaction)	35%	1	Connection to others (mostly community interaction)	70%

Other differences between home and community gardeners

We care about the **health**, **social value** and **happiness** benefits from urban agriculture

But are these benefits perceived in the same way?



Home Gardeners
"subtle sociability"

more motivated by health

Community Gardeners
"overt sociability"

more motivated by connection to others

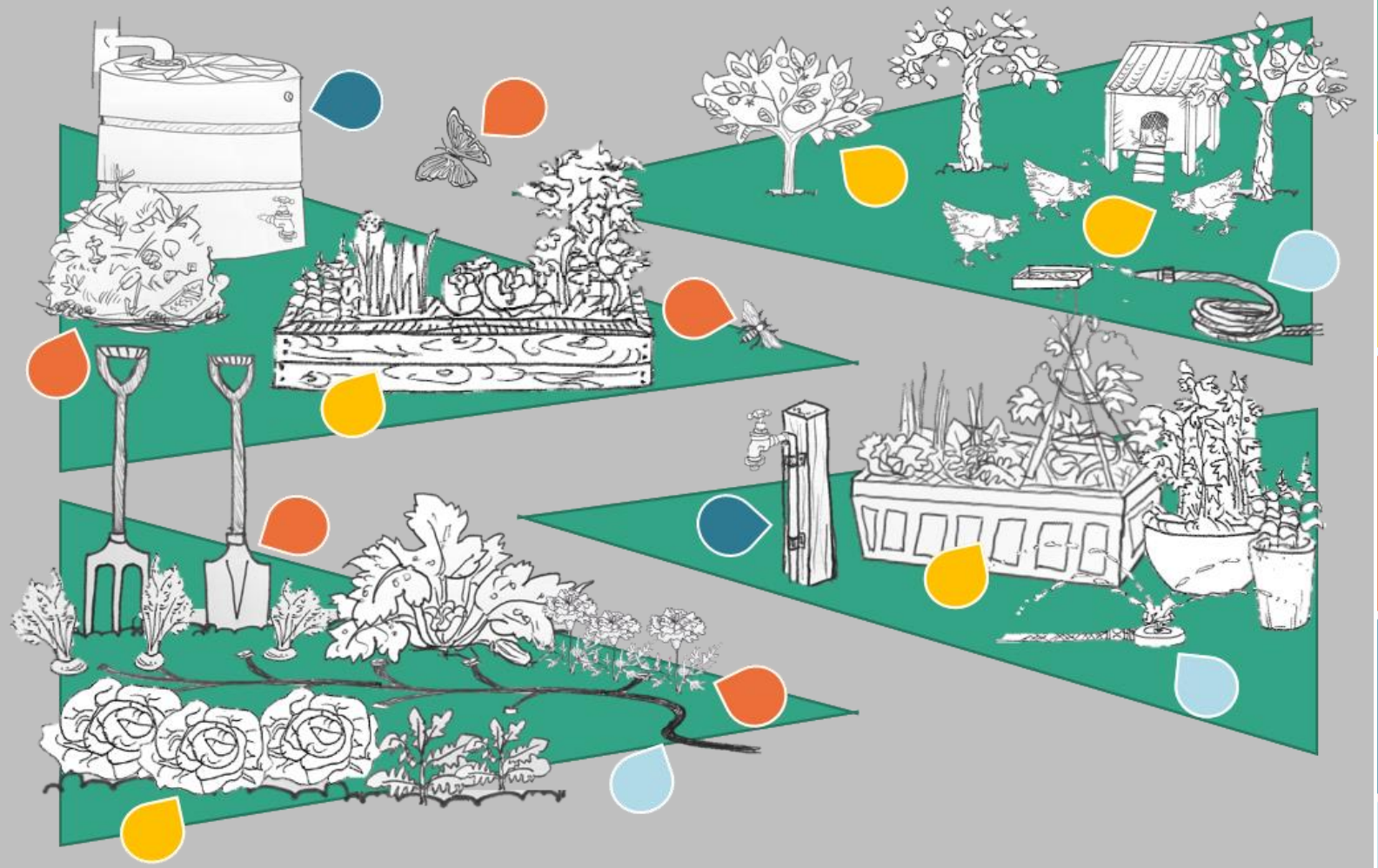
Both are motivated by **tasty, fresh produce** and **enjoyment,** and most **share food**

Both home and community food gardening may help support **resilient health & wellbeing**

Beyond productivity: Considering the health, social value and happiness of home and community food gardens
G. Pollard, P. Roetman, J. Ward, B. Chiera and E. Mantzioris
Urban Science - 2018

To read more about this visit: https://www.mdpi.com/2413-8851/2/4/97/htm

The greatest finding from the survey?
The incredible diversity of people's food gardens!



Total area under production: small 5-15m2 (28%) OR medium 16-30m2 (28%).
Gardening consistency: "All year round" 62%

Typical no. of production methods: 4

Top 5 production methods: 1. Fruit trees (84%), 2. Pots & planters (74%), 3. In-ground beds (70%), 4. Raised beds (61%), 5. Poultry– chickens (39%)

Typical no. of gardening approaches: 4

Top 5 gardening approaches: 1. Composting (70%), 2. Conventional digging & tilling (66%), 3. Organic (57%), 4. Companion planting (53%), 5. Low use of chemical pesticides & pesticides (48%)

Typical no. of water sources: 2

Top 2 water sources: 1. Mains water (82%), 2. Rainwater (60%)

Typical no. of irrigation methods: 3

Top 3 irrigation methods: 1. Manual (86%), 2. Drip irrigation (51%), 3. Sprinkler (25%)

From our scientific paper: "Typically diverse: The Nature of Urban Agriculture in South Australia"

We also found out about estimated inputs and challenges…

Typical time spent: 4 hours per week (range = <1—30 hours)

Typical setup cost: $500 (range: $0—$20,000)
Typical monthly cost: $30 (range = $0—$1,000)

Do you produce food to save money? 47% 'Agree'
Do you think you succeed in saving money? 48% 'Yes, some money'

Top 6 original challenges: 1. Lack of time; 2. Unsuitable space, soil, climate; 3. Not enough space; 4. Lack of knowledge; 5. Livestock, pet or pest issue; 6. Cost

Do you experience any current challenges?
38% = 'No', 62% = 'Yes'

Top 6 current challenges: 1. Lack of time; 2. Unsuitable space, soil or climate; 3. Livestock, pet or pest issue; 4. Water issues; 5. Physical / health issues; 6. Cost

From our scientific paper: "Typically diverse: The Nature of Urban Agriculture in South Australia"

A screenshot of our very detailed dataset which has almost 10,000 entries.
This will be available online and open-access soon.

Date	Month	Year	Season	Garden ID	Area ID	Growing area (m2)	Tech-Crop Combination	Activity	Labour (mins)	Expense ($AUS)	Water (L)	Corrected Yield (kg)	Yield (kg/m2)	Water (L/m2)	Produce name	(Average) Harvested retail price ($/corrected yield):	Energy (kJ/kg) per harvest amount (/edible%)	Protein (g/kg) per harvest amount (/edible %)	Weight of produce shared	Shared with
8/04/2017	4	2017	AUTUMN	100	163	80	bed-vine	rwtank	10		46			0.58						
8/04/2017	4	2017	AUTUMN	42	108	54	bed-veg/vegh/herb/oth	soil	40											
8/04/2017	4	2017	AUTUMN	111	277	10	bed-orch	soil	30											
8/04/2017	4	2017	AUTUMN	100	162	20	chkn-egg	stock	10		15			0.75						
8/04/2017	4	2017	AUTUMN	42	108	54	bed-veg/vegh/herb/oth	water	30		3200			59.70						
8/04/2017	4	2017	AUTUMN	38	176	50	bed-veg/vegh/herb/oth	water	5		585			11.70						
9/04/2017	4	2017	AUTUMN	157	308	9	raised-veg/vegh/herb	build	30											
9/04/2017	4	2017	AUTUMN	77	184	36	raised-veg/vegh/herb	hrvst	5			0.6	0.017		rhubarb	$7.71	344	5		
9/04/2017	4	2017	AUTUMN	77	185	10	chkn-egg	hrvst	10			0.65	0.065		eggs 16	$5.51	3319	72		
9/04/2017	4	2017	AUTUMN	100	162	20	chkn-egg	hrvst	3			0.39	0.020		eggs 7	$3.31	1992	43		
9/04/2017	4	2017	AUTUMN	145	297	6	chkn-egg	hrvst	5			0.13	0.022		eggs	$1.10	664	14		
9/04/2017	4	2017	AUTUMN	100	161	30	raised-veg/vegh/herb	hrvst	10			0.25	0.008		capsicum	$1.81	106	2		
9/04/2017	4	2017	AUTUMN	77	184	36	raised-veg/vegh/herb	hrvst	10			0.6	0.017		Carrots	$1.29	341	2		
9/04/2017	4	2017	AUTUMN	42	108	54	bed-veg/vegh/herb/oth	hrvst	15			0.8	0.015		Chillies	$14.59	1402	15		
9/04/2017	4	2017	AUTUMN	100	161	30	raised-veg/vegh/herb	hrvst	5			0.28	0.009		cucumber	$1.67	137	2		
9/04/2017	4	2017	AUTUMN	77	184	36	raised-veg/vegh/herb	hrvst	5			1.2	0.033		Egg Plant	$9.67	961	11		
9/04/2017	4	2017	AUTUMN	42	108	54	bed-veg/vegh/herb/oth	hrvst	3			0.25	0.005		Eggplant	$2.02	200	2		
9/04/2017	4	2017	AUTUMN	77	186	35	raised-veg/vegh/herb	hrvst	30			3	0.086		potatoes	$8.66	6707	59		
9/04/2017	4	2017	AUTUMN	137	257	2	raised-veg/vegh/herb	hrvst	1			0.05	0.025		beans	$0.49	61	1		
9/04/2017	4	2017	AUTUMN	77	184	36	raised-veg/vegh/herb	hrvst	5			0.5	0.014		Spinach	$7.02	374	10		
9/04/2017	4	2017	AUTUMN	100	161	30	raised-veg/vegh/herb	hrvst	10			0.24	0.008		spinach	$3.37	179	5		
9/04/2017	4	2017	AUTUMN	137	257	2	raised-veg/vegh/herb	hrvst	2			0.9	0.450		zucchini	$6.31	511	7		
9/04/2017	4	2017	AUTUMN	100	164	1	aqua-fivg	other	5						feeding fish					
9/04/2017	4	2017	AUTUMN	77				purch		$45.00										
9/04/2017	4	2017	AUTUMN	100	163	80	bed-vine	rwtank	25		168			2.10						
9/04/2017	4	2017	AUTUMN	145	295	24	raised-veg/vegh/herb	rwtank	21		156			6.50						
9/04/2017	4	2017	AUTUMN	100	162	20	chkn-egg	share	15						eggs 36				2.12	fmly
9/04/2017	4	2017	AUTUMN	157	308	9	raised-veg/vegh/herb	soil	10											
9/04/2017	4	2017	AUTUMN	157	308	9	raised-veg/vegh/herb	sow	16											
9/04/2017	4	2017	AUTUMN	77	186	35	raised-veg/vegh/herb	water	10		780			22.29						
9/04/2017	4	2017	AUTUMN	77	185	10	chkn-egg	water	10		19			1.90						
9/04/2017	4	2017	AUTUMN	77	184	36	raised-veg/vegh/herb	water	30		1360			37.78						
9/04/2017	4	2017	AUTUMN	38	176	50	bed-veg/vegh/herb/oth	water	5		542			10.84						
9/04/2017	4	2017	AUTUMN	157	303	0	pot-veg/vegh/herb/othe	water	1		0.5			1.25						

Open-access means that anyone can view, download and use this data for free!
(This is unusual for most scientific publications)

School Food Gardens

Although community gardens and school gardens only constitute a small fraction of UA activity, they can still have considerable positive impacts on everyone involved.

Of the two schools we built relationships with, this school collected an impressive amount of data:

Blair Athol North B-7 School

Garden ID:	173	Total area (m2):	350	Length of data collection: (in days)	528

Garden Area No:	Size:	Production method:	Typical crop:	Water source:
1	300	Raised garden bed	Vegetables & Herbs mixed	Rainwater with pump
2	50	Poultry keeping (chooks)	Eggs	Rainwater with pump

Blair Athol North B-7 school asked for a spreadsheet to help them track their harvests across the year.

	Produce name	produce code	# of entries	total kg	1 JAN	2 FEB	3 MAR	4 APR	5 MAY	6 JUN	7 JUL	8 AUG	9 SEP	10 OCT	11 NOV	12 DEC	SUMMER	AUTUMN	WINTER	SPRING
	Vegetables																			
1	Artichoke	arti*	3	2.44	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	1.4	0.0	0.0	0.0	1.1	1.4
2	Asian Greens	asian*	3	0.65	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0
3	Asparagus	asp*	9	4.94	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	3.4	0.7	0.8	0.0	0.0	0.0	0.1	4.9
4	Beans	bean*	7	1.92	0.0	0.0	0.4	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0
5	beetroot	beet*	13	5.05	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	2.1	2.2	0.0	0.0	0.8	0.0	4.3
6	broad beans	broad*	11	15.67	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	10.5	4.9	0.0	0.0	0.0	0.0	15.7
7	brocoli	broc*	28	7.53	0.0	0.0	0.0	0.0	0.6	2.1	0.9	2.0	0.6	1.1	0.3	0.0	0.0	0.6	4.9	2.0
8	cabbage	cab*	1	0.10	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
9	Capsicum	cap*	8	1.60	0.0	0.2	0.3	1.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.3	0.1	0.0
10	carrots	carr*	6	2.01	0.0	0.0	0.2	0.0	1.1	0.0	0.0	0.3	0.0	0.0	0.4	0.0	0.0	1.3	0.3	0.4
11	cauliflower	caul*	1	0.64	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0
12	celery	cel*	10	1.76	0.0	0.2	0.9	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.2	0.9	0.7	0.0
13	Chilli	chil*	19	2.71	0.0	0.6	1.7	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.6	2.1	0.1	0.0
14	Corn	corn*	5	3.18	0.0	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0	0.0
15	Cucumber	cucu*	9	4.49	0.0	2.6	0.8	0.7	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	1.9	0.0	0.0
16	Eggplant	eggp*	25	22.64	0.9	4.1	8.6	4.2	4.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	5.0	16.8	0.8	0.0

This excel spreadsheet included their harvests of fruits, herbs, vegetables and chicken eggs.

This was part of their final report – they garden definitely saved money! *Note the impact of herbs on the total value.

A Financial Breakdown of your School Garden's Data

Harvest Categories	Yield (kg)	% of Total Yield	Average retail value ($AUS):	% of Total Value	
Herbs	25.62	6%	$3,804.76	50%	
Fruits	160.50	39%	$1,235.96	16%	
Vegetables	196.65	47%	$2,360.41	31%	
Animal products	32.93	8%	$282.54	4%	
TOTAL:	**415.69**		**$7,683.67**		
		Retail value without herbs:	**$3,878.91**		
		Total recorded costs:	**-$1,555.69**		
		Net position:	**$6,127.98**	**OR $2323.22**	(without herbs)

There is great potential for further research into school food gardens, particularly the inclusion of a simple measurement and monitoring program to improve practical food skills and act as a "hands on" pathway for STEM based learning.

What we learnt:

Our 5 science secrets

Please note!

These “secrets” are based on our analyses, results and findings which will soon be published as a new scientific paper. Please keep your eye out for it and cite this information accordingly ☺

1 Producing food doesn't take as much time as people think

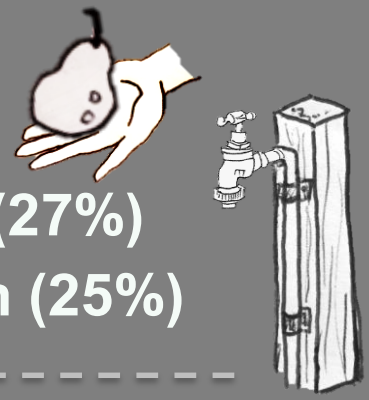
(once you get going)

Reported median time spent from the **survey:**

3.4 hours / week

Recorded median time spent from **garden data**:

1.3 hours / week



Harvesting (27%)

All irrigation (25%)

Weeding / Pruning (9%)

Livestock care (8%)

Soil prep / mulch (7%)

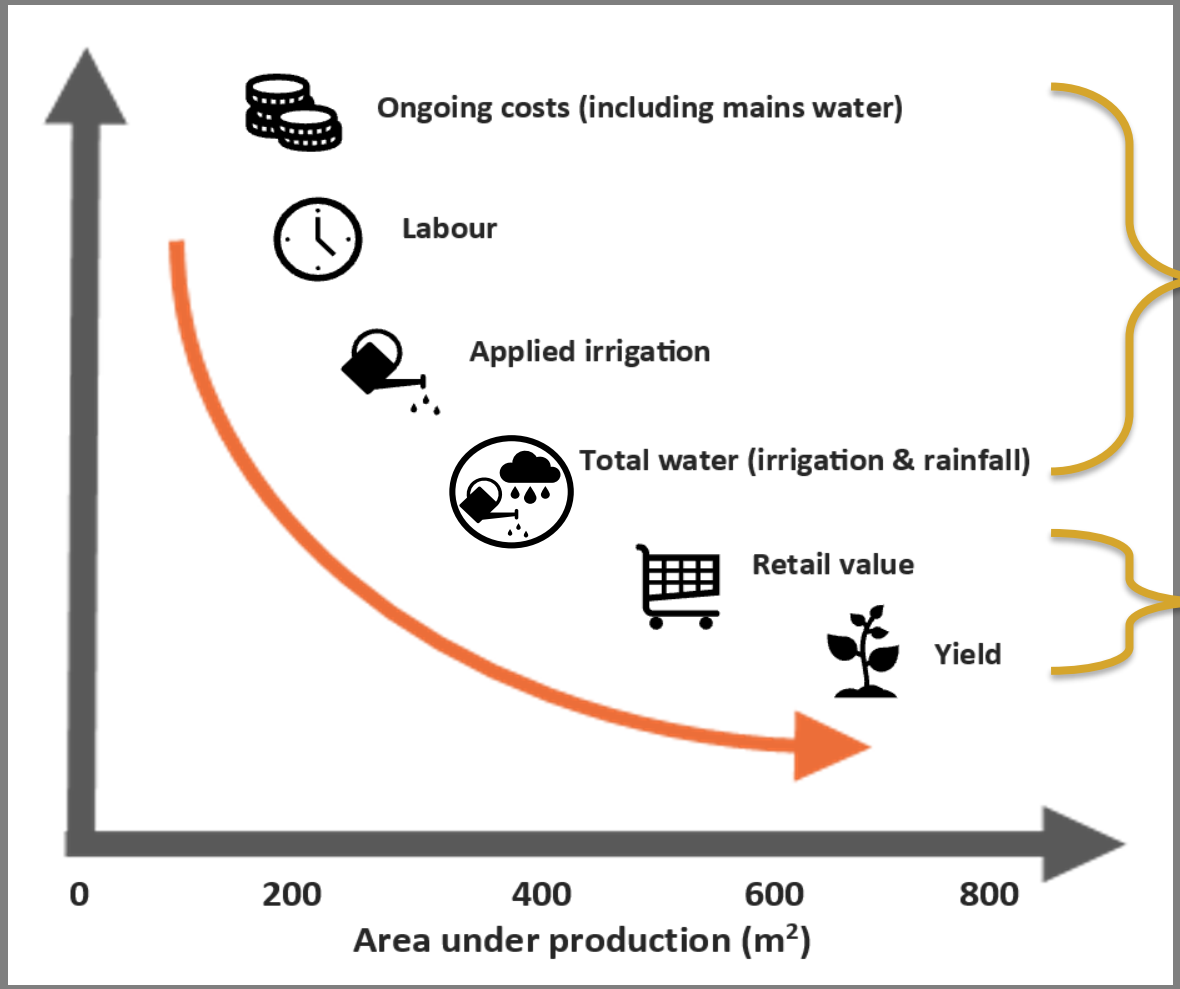
Building (7%)

Planting / sowing (6%)

2 Garden size does matter!

(but not the way you might think)

As the area under production increases…

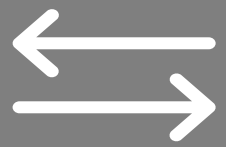


Not only do all of the major inputs per unit area go down…

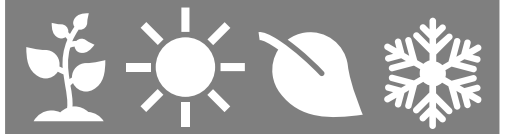
But the major outputs per unit area also go down.

3 Diversity can help your food garden
(Just don't go too far!)

Some diversification of cultivation techniques can help to:



even out
the inputs and outputs of a single garden



provide
more consistent year-round harvests

produce
the most even (& diverse) combination of foods

Other ways to diversify:

Mixing crop types or varieties to produce a range of early-, standard, and late-season crops.

4 Home gardeners… can save money "growing their own"
(Under CERTAIN CIRCUMSTANCES!)

If you ignore your setup costs.

(almost)

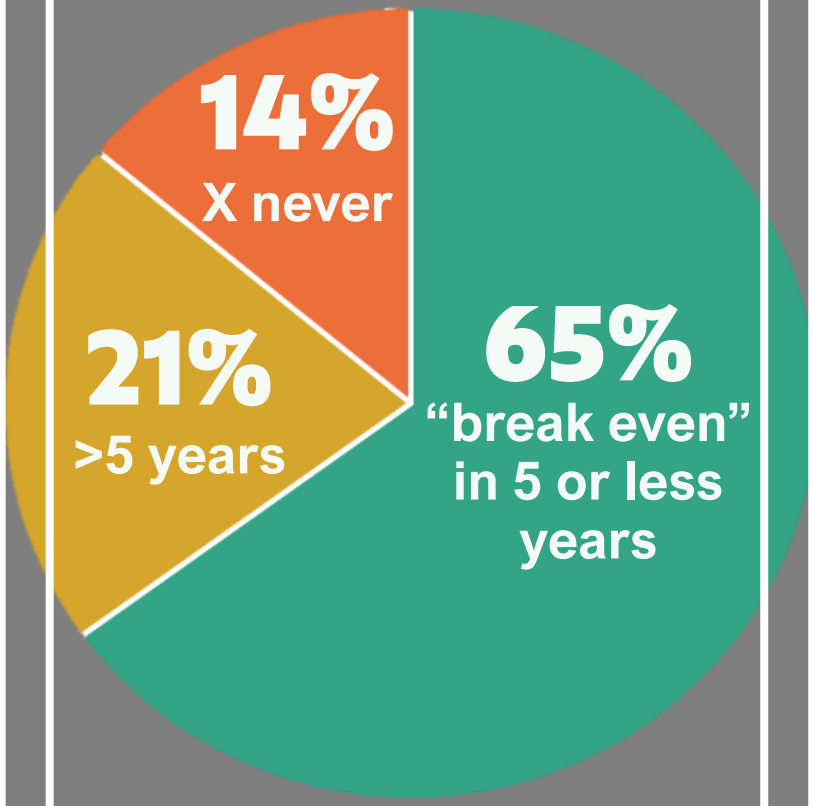
80%

Of the EG gardeners would save more than

$250

per year.

If you do consider your setup costs.



If you apply a wage rate to your time

(just over)

1 in 6

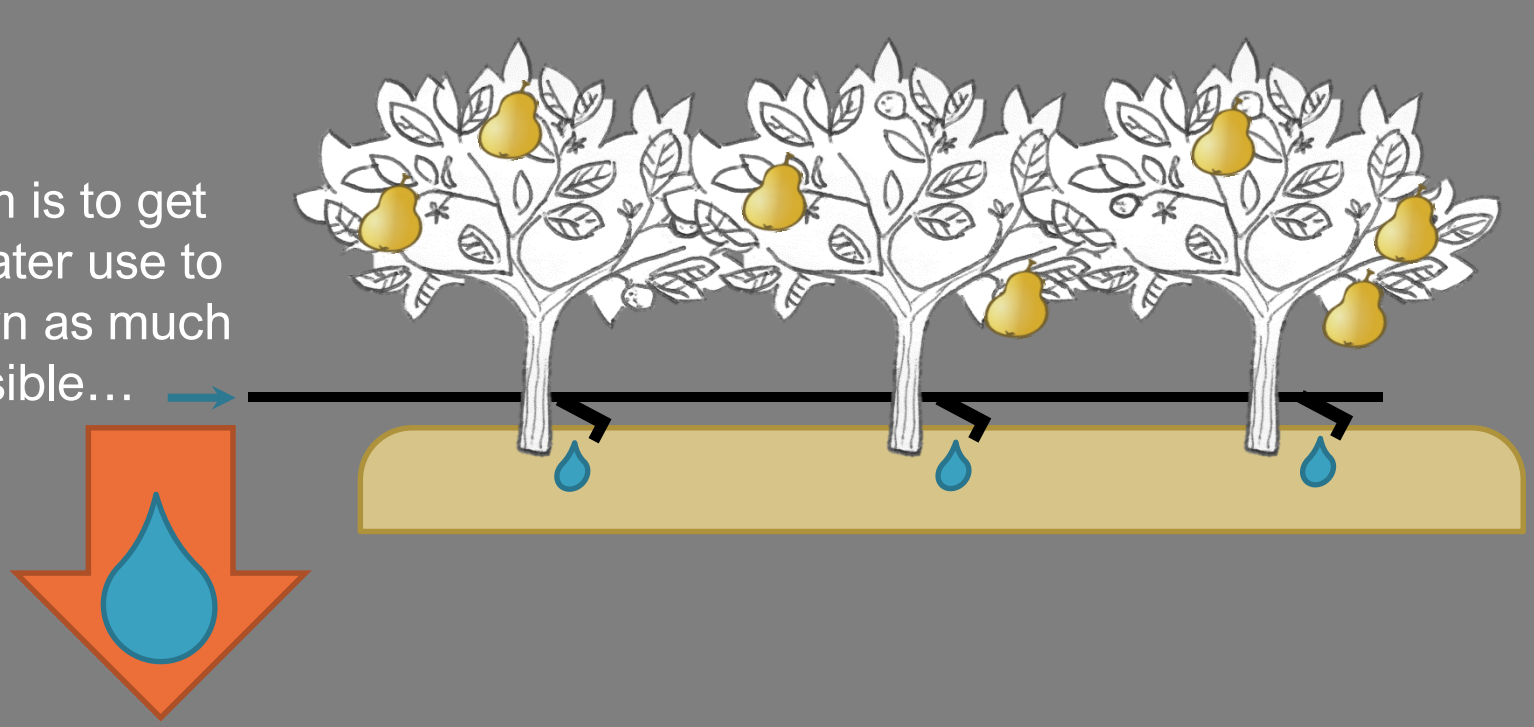
EG gardeners produced enough to effectively pay themselves

Minimum wage ($18.93/hr)

5 Water is a BIG deal for food gardens
(It's all about "water use efficiency")

"Is a measure of how ***efficiently production systems convert water*** (rainfall and/or irrigation) ***into a harvestable yield or into money"*** (Pollard et al. 2018, pg. 4).

The aim is to get your water use to go down as much as possible…



While keeping your yields the same or better.

From our scientific paper: "Water use efficiency in urban food gardens: Insights from a systematic review and case study"

We developed 3 water use efficiency equations

(Total water is irrigation + rainfall)

$$WUE_{gross} = \frac{\sum Y}{\sum W}$$

Gross Water Use Efficiency
= total yield to total water use

(looks like)
2.5 kg / 1 kL

$$WUE_{nut} = \frac{\sum(Y_k N_k)}{W}$$

Nutritional Water Use Efficiency
= total nutritional unit of yield to total water use

(looks like)
4,247 kJ / 1 kL

$$WUE_{fin} = \frac{\sum(Y_k F_k)}{W}$$

Financial Water Use Efficiency
= total retail value of yield to total water use

(looks like)
$38.16 / 1 kL

If WUE does become a key metric for measuring the success of UA – this will help shift the focus from pure productivity, to a more inherently sustainable focus of food, water and land.

What now?

Using these foundations

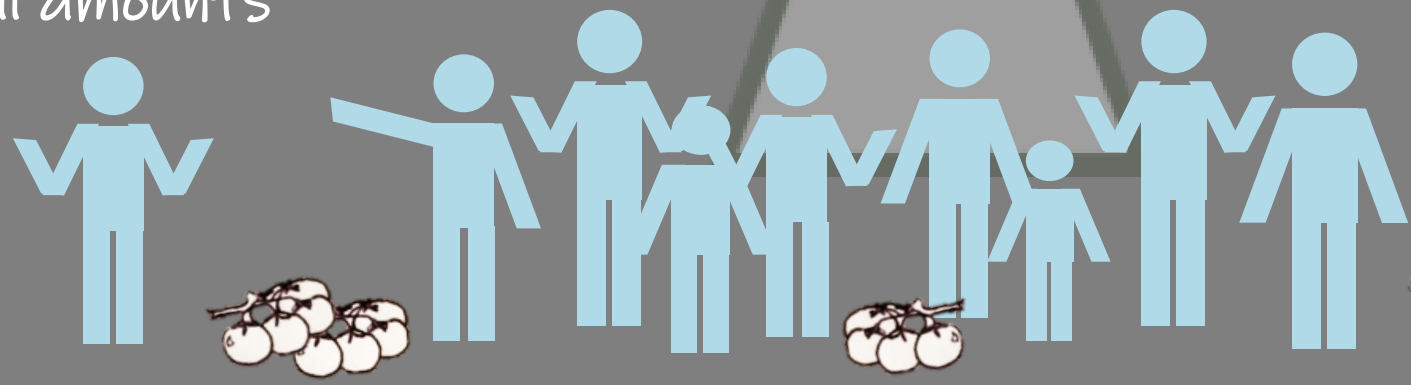
Yet we still face the challenge of

High variability

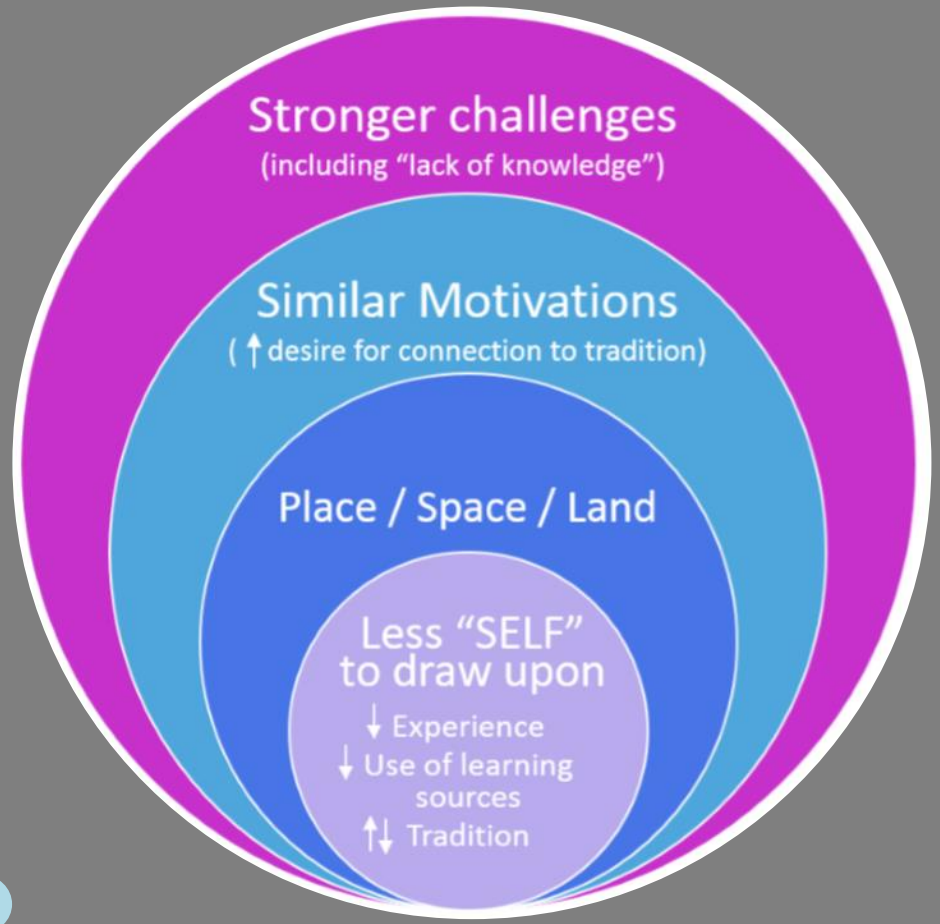
Some people grow food extremely well

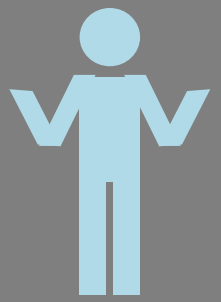
productivity & resource efficiency

Many people grow only small amounts



Theoretical comparisons between:

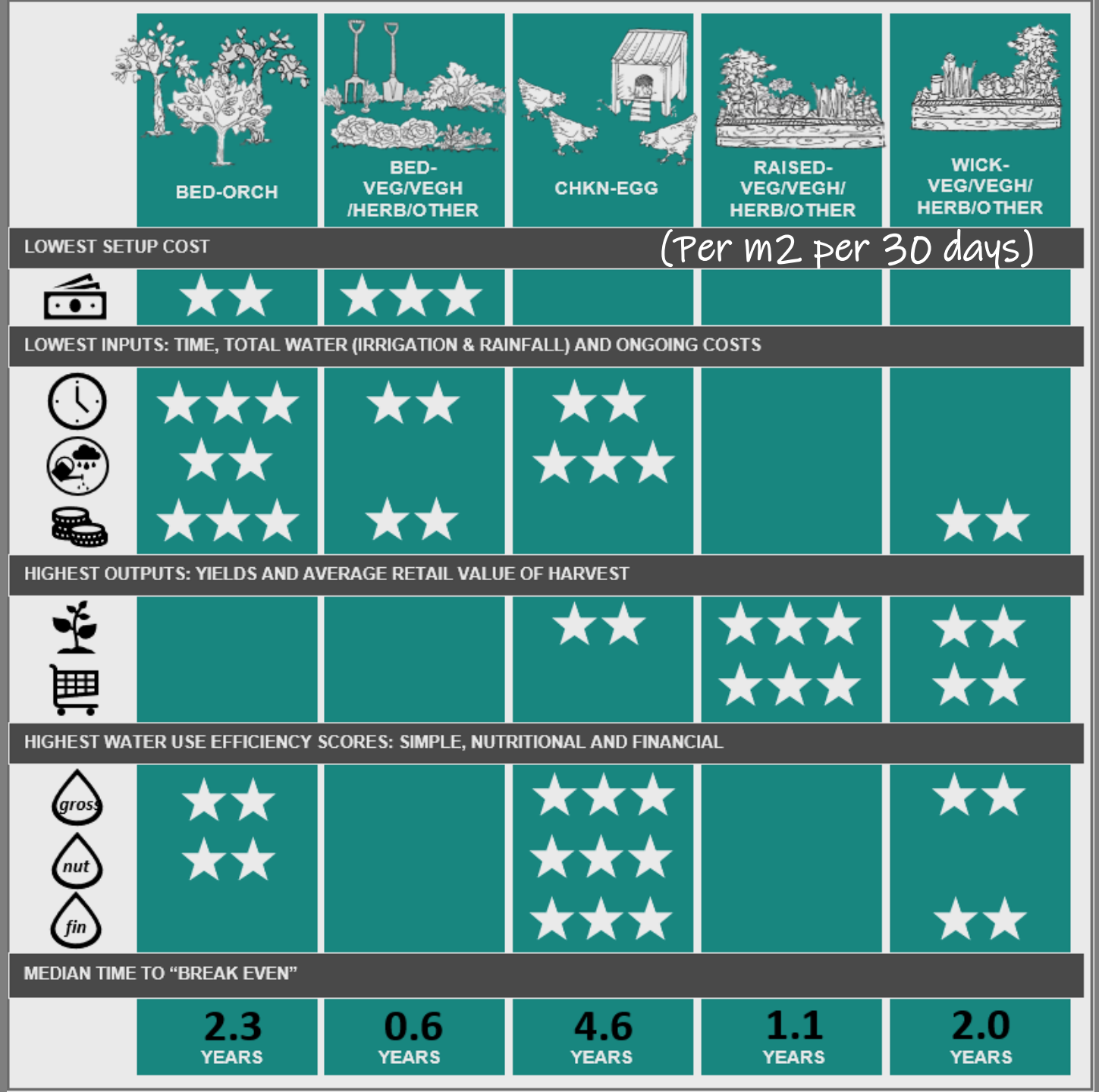




Less Experienced Gardener

Experienced Gardener

Motivations and challenges can be matched to the most appropriate garden areas.



What are *your* key motivations?

What are *your* key challenges?

Key points for Local Councils

- Home food gardens are the ***largest target*** for potential sustainable change in local food.
- Support ways for gardeners to ***learn from each other*** (food swaps, garden meet ups, workshops, grow free carts etc.)
- ***Support businesses*** who want to use locally home grown produce.
- Guide low-income households on ***cost effective*** ways to set up a new food garden.

Thoughts for potential future businesses

Setup costs may be a serious challenge

Labour is going to be one of the largest costs $$$

But there are likely combinations of labour-saving techniques and tools

Can they get a retail or wholesale price?

Home gardens are the potential building blocks of future commercial UA businesses.

Where to from here?

Our final paper will be published soon and the raw data made publicly available.

Work will continue with:

SA Urban Food Network

We are what we eat

We invite you to join the SA Urban Food Network, which is working towards a sustainable food system.

The network aims to:

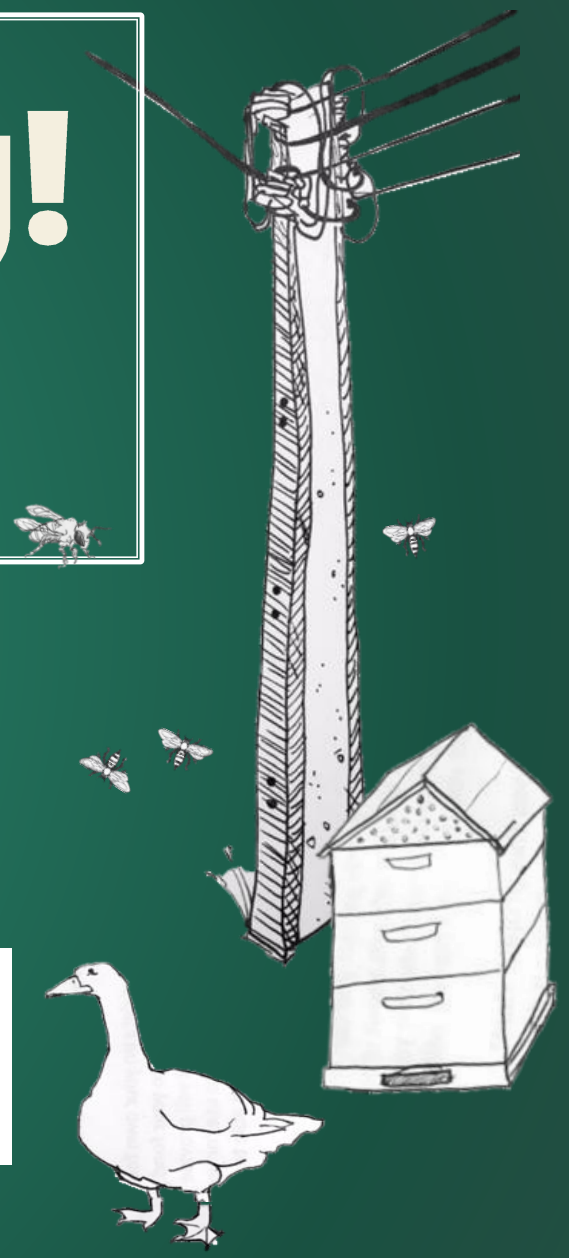
- **exchange** connections, knowledge and opportunities across local organisations, community groups and individuals
- **educate** and build capacity across the food system
- **enable** the transition to a sustainable local food system.

Take Home Messages

- Broadest range of input and output data ever collected on existing home food gardens. All publicly available and open-access!
- People can save money by "growing their own" – if they produce a reasonable amount of food and are thrifty with their resources.
- By increasing people's awareness of the in's and out's of their food gardens and by providing some guidance along the way – we can hope to increase the flow of fresh food to ourselves and others and contribute more to our vision of a sustainable urban future.

Thanks for listening!

Any further questions?



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CITY OF MARION

CITY OF Salisbury

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