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High Desert Climate Response in Cohousing

Introduction

A high desert is a climate of extremes. While always dry, the temperature swings strongly between night, day and season. Appropriate building response is not only recommended, but essential for survival in such a climate. Even during the summer, ground frosts are not unheard of. Because of this growing seasons in the high desert are only between the beginning of July and end of August.

- Average annual precipitation of 10-13 inches.
- In winter temperatures range from 30-50ºF in the day time to 22-51ºF at night.
- The summer days roam in the 90ºF's and the 40ºF's at night.

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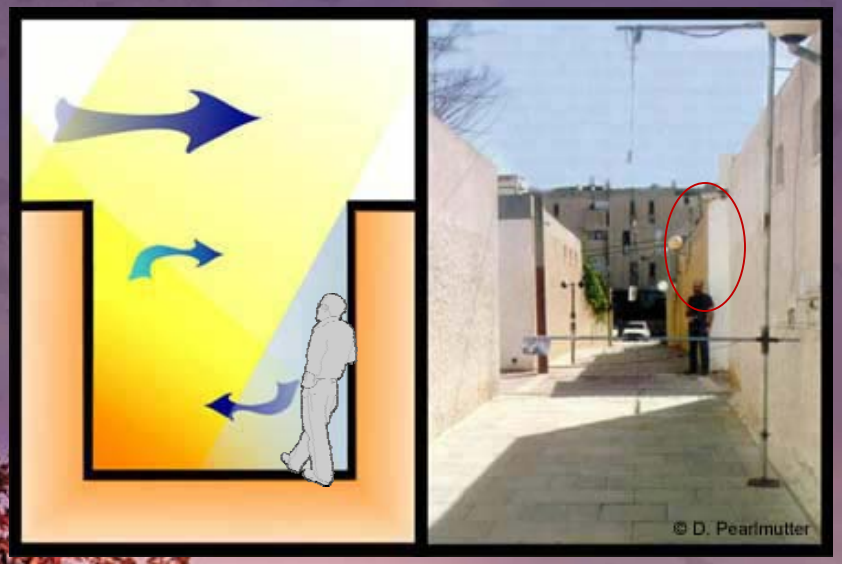
Climatic Responses from the Street

Neve-Zin pedestrian path



The "compact" urban street canyon
•only applies to dry climate
•shade from the building creates cool space in the

the use of vines trellised overhead
summer: creates shade for pedestrian
winter: allows the light into space
(warms the space)

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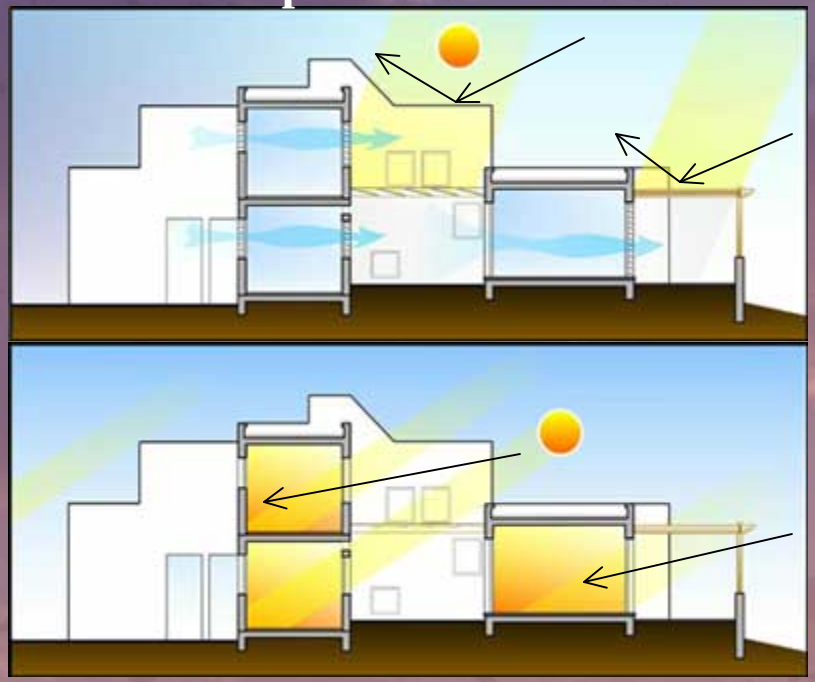
Climatic Responses from Housing

natural ventilation

unobstructed openings like open windows should be between 6 to 7.5 percent of total floor area

southern exposure



summer

winter

orientation for solar glazing is within 5 degrees of true south

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overhead door

summer: <u>opened overhead door</u>
invites natural breeze, creates open outdoor space
winter: <u>closed overhead door</u>
sunspace, stores heat (thermal comfort)

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Case Studies At a Glance

Summer

Shading

Passive ventilation

Evaporative cooling with fountains

Winter

Passive solar heating

Gardens/ green houses

All Year

Material Choices

Solar thermal / photovoltaic systems

Thermal mass

Strategy	Christie Walk	Santa Fe	Pinakarri
Shading	Yes	Yes	Yes
Passive ventilation	Yes	Yes	Yes
Evaporative cooling	No	Yes	No
Passive solar heating	No	No	Yes
Gardens/green houses	Roof Garden	Green Houses	Gardens
Material choices	Yes	Yes	Yes
Solar thermal / voltaic systems	Hot water/ power	No	No
Thermal mass	Yes	Yes	Yes

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Christie Walk EcoCity:

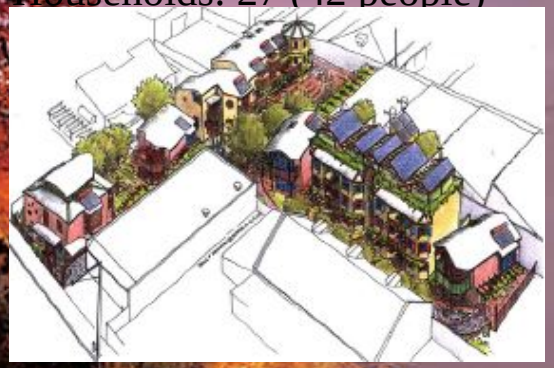
105 Sturt Street, Adelaide, Australia

"The goal of this housing project is to create a live-able, affordable and environmentally benign urban community that provides a practical prototype for the ecological development of our cities".

Goals: energy efficiency
high overall ecological performance
user-participation
ethical investment funding base

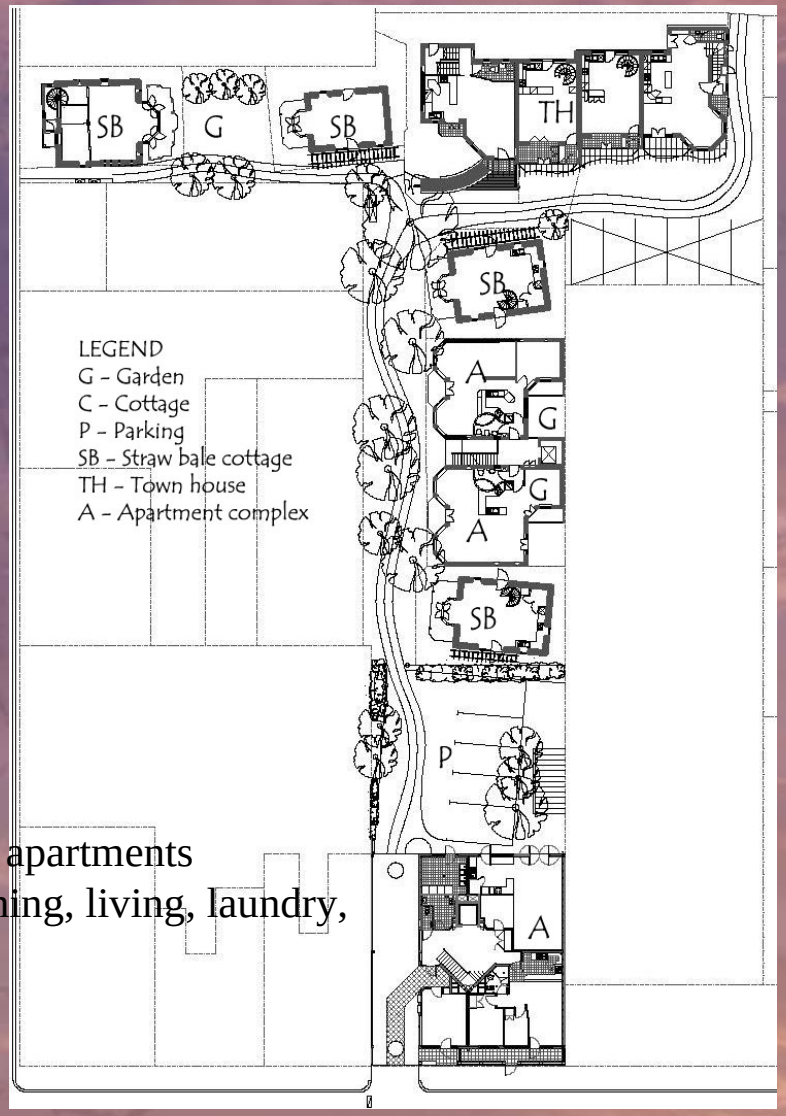
Site: 2000sq meters

Households: 27 (42 people)



Design:

4 townhouses
6 apartments
5-story building with 13 apartments
(communal kitchen, dining, living, laundry, toilets)
4 straw-bale cottages
1 community garden
1 rooftop garden



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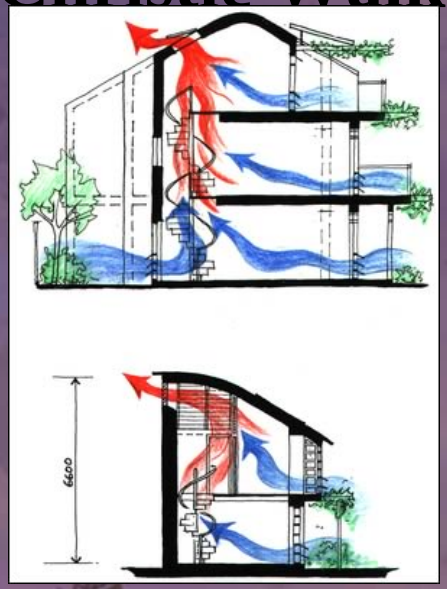
Christie Walk EcoCity:



Ventilation Diagram (Photograph provided by Urban Ecology Australia)

Townhouse Vegetation (Photograph provided by Ecopolis Architects)

Summer:

"Each house works as a 'thermal flue' allowing controlled release of warm air whilst drawing in filtered, cooled air from the vegetated, landscaped surroundings… the development is not complete until the accompanying landscaping is complete. The apartments rely on good cross-ventilation and high thermal mass for cooling with the roof garden adding a thermal buffer to the upper floor apartments".

- Thermal mass – Concrete slabs, Earthcrete' walls, and straw bale provide mass and absorb the heat from the day.
- Ventilation – Small windows located low with vents or louvers located high. Note diagram.
- Landscaping and roof garden - Dwellings draw cool air through vegetation. The roof garden acts as a buffer.

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Christie Walk EcoCity:

Townhouse Vegetation (Photograph provided by Ecopolis Architects)

Straw bale cottage (Photograph provided by Ecopolis Architects)

Permaculture Path (Photograph provided by Urban Ecology Australia)

Winter:

"Some ceiling fans are included to assist in maintaining air flow on still days, but no heaters or air-conditioners were provided and the expectation was that none would be needed to supplement the passive heating and cooling of the houses".

<u>Thermal mass</u> – Internal mass absorbs and retains heat

<u>Landscaping</u> – Vegetation falls and allows light into dwellings

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Christie Walk EcoCity:

Solar Hot Water Panels (Photograph provided by Ecopolis Architects)

All Year:

- Storm water collection – used for irrigation and flushing toilets
- Solar hot water
- Power from photovoltaic panels - Community is designed to use less and is able to sell the additional power.
- Shared gardens/Local food production

•Sources:

http://www.urbanecology.org.au/christiewalk/

http://www.greenhouse.gov.au/yourhome/technical/fs73.htm

http://www.ecopolis.com.au/projects/christie.html

Solar Townhouses (Photograph provided by Ecopolis Architects)

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The Commons; Co-housing in Santa Fe New Mexico

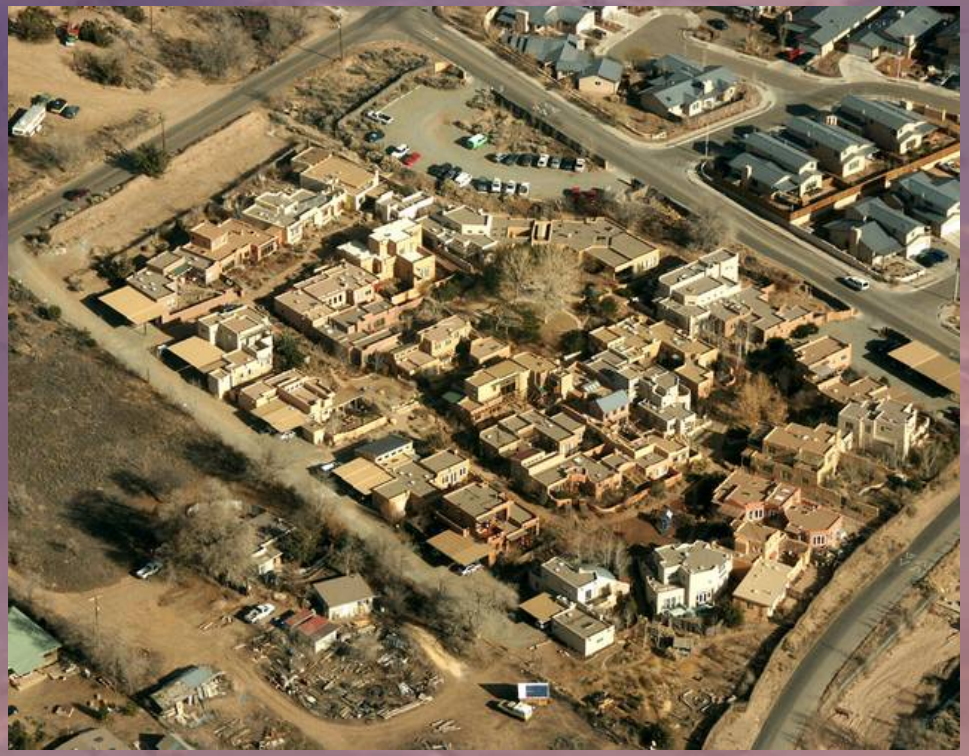
A pueblo-style co-housing community on 4.5 acres of land on the outskirts of Santa Fe.

Completed in 1997

Twenty eight houses clustered around four landscaped courtyards

Home businesses and common house around central courtyard.

Consensus based decision making.



"a spirit of conviviality and neighborliness"

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The Commons: Summer Climate Response

- A large courtyard in the center of the commons has a water fountain that could be used for an evaporative cooling effect.
- Many walk ways are covered by climbing plants.

- These plants provide shelter in the harsh summer but allow light and warmth through in the winter.
- Adobe buildings' deep walls allow for small fountains, covered entrances, and cool rest areas.

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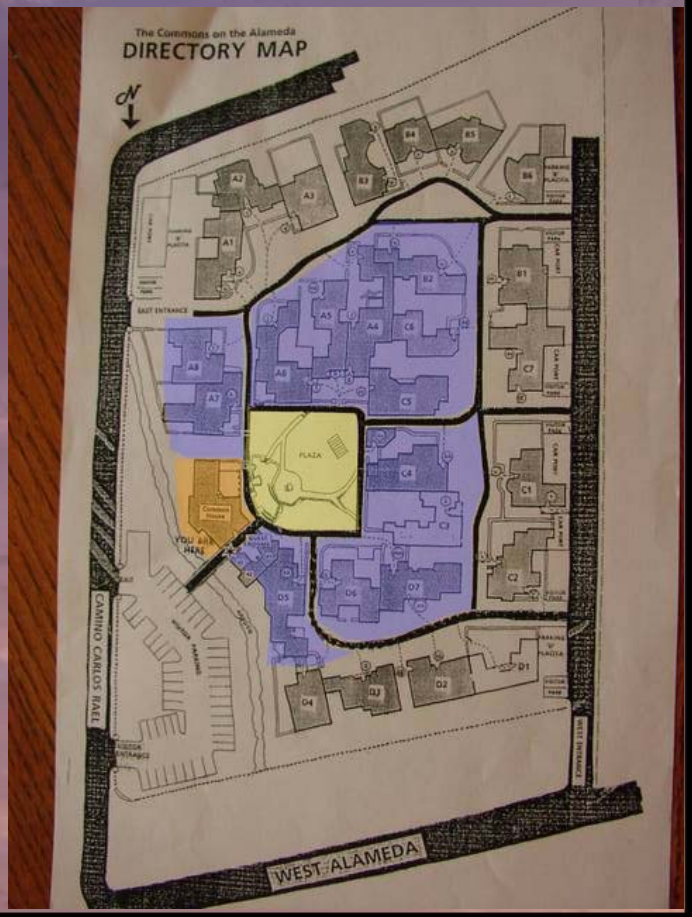
The Commons; Winter Climate Response

- Four Courtyards are surrounded on all sides by homes. These homes block wind and the harshest of weather conditions, to protect the courtyards as long as possible.
- Many homes have kitchen gardens inside.



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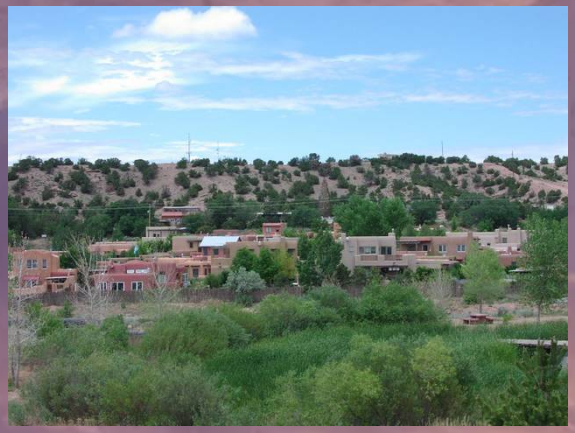
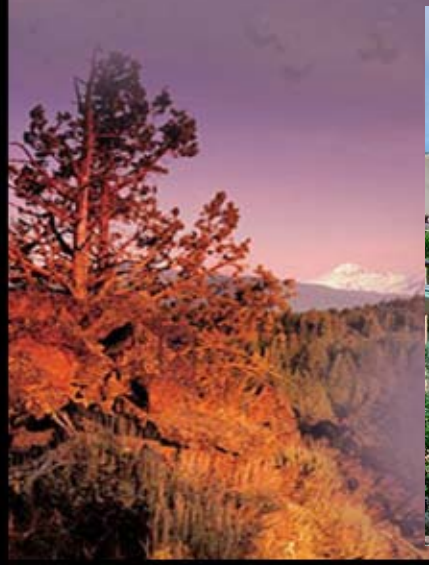
The Commons; Year-Round Climate Response

•Large adobe buildings provide thermal mass for passive cooling in the hot summer months and passive heating in the winter months.





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Pinakarri Co-housing Community: Case Study

Planning & Design- Richard Hammond of Richard Hammond and Green
Location- North of Port Hedland, Western Australia
Number of Structures: common house, 8 non-equity rental properties, 4 privately owned houses
Population- 17 adults & 14 children + outsiders who often stop by to visit

Community Vision: When they started the co-op the members envisioned a sustainable and secure community that would be run by it's residents.

Started in 1991, the Pinakarri Community became the first housing co-op with renters and owners in Western Australia. Because of their interest and implementation of sustainable ideas they have become a model for all other co-housing communities around Australia and the world. I chose this place to study due to the fact that they were pioneers in green design for communities.

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Summer

Passive Ventilation

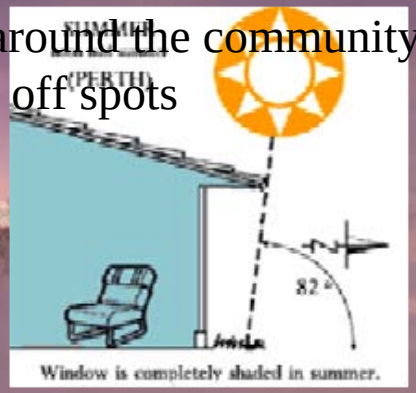
•because of there east west axis orientation, the homes at Pinakarri are very efficient

•louver windows are placed high on the eastern and western ends to not allow a lot of sunlight and to permit the cool sea breeze to pass through each house

Shading

•longer eaves and louvers create more shade and less sun

•courtyards around the community are a ting nice outdoor cool off spots



Window is completely shaded in summer.

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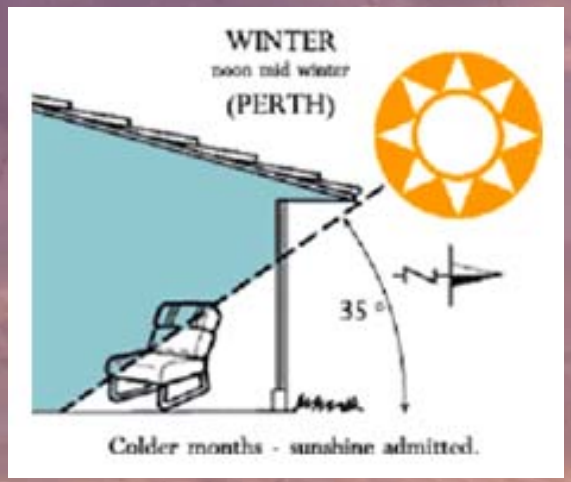
Winter

Passive Solar Heating

•the difference between the Winter months and Summer months at Pinakarri aren't to different, but even with the slight temperature change, the community had the architect put it more large North facing windows to let more sunlight in. After the light passes through the windows, they hit a ceramic tile or concrete floor that is used as thermal mass.



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All Year

Permaculture

•used as a way to unite the community while providing food, permaculture is a vital part of the Pinakarri community. This way of agriculture lets people socially interact with each other and learn how to provide a source of food for themselves.

Thermal Mass

•in each of their houses, ceramic tile or concrete flooring pr
build

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Design Lessons

- For a sustainable cohousing program, gardens are a must. The short growing season in a high desert makes interior gardens or green houses essential for year long production

- With extremes in temperature all year long, from day to night. The good news is that there is plenty of sun so thermal mass and solar design strategies can be very effective.

- Winter and summer are completely different worlds in a high desert environment. Successful strategies will be effective no matter the season.

- When deciding the configuration of your cohouses, think about the space in between. The way this space works decides not only social aspects, but climatic as well. Will your shared areas be windswept tunnels, or comfortable avenues?

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Sources

Strategies

http://en.wikipedia.org/wiki/Bend%2C_Oregon	(bend climate)
http://ag.arizona.edu/OALS/ALN/aln47/pearlmutter.html#intro	(urban street canyon)
http://eetd.lbl.gov/heatisland/CoolRoofs/	(cooler roofs)

Examples

http://www.santafecohousing.org	(santa fe)
http://home.bendbroadband.com/higherground/	(highground)
http://www.urbanecology.org.au/christiewalk/	(christie walk)
http://www.ecopolis.com.au/projects/christie.html	(christie walk)
http://www.pinaharri.org/au	(pinakarri community)
http://www.bom.gov.au/weather/wa/port_hedland/climate.shtml	(australian weather)