Hawaiian State Emergence

Patrick V. Kirch
Polynesian voyagers arrived in the Hawaiian Archipelago around A.D. 800-1000.

*Hokule‘a* off the windward Moloka‘i coast.
The Hawaiian Archipelago

Age gradient of the archipelago. Hawai‘i = 0.5 ma Kaua‘i = 5-6 ma
Emergent Cultural Complexity in Late Pre-European Contact Era

Emergence of a highly stratified society out of chiefdom cycling; marked by **kingship** and its correlates ("archaic state")

Class endogamy and land alienation from commoners (territorial land system)

Economic specialization and agricultural intensification

Organized surplus extraction and corvéée labor
Hawaiian elites elaborated the symbols and privileges of chiefship and kingship

The highest ranked chiefly lines were said to be descended from the gods.

The piʻo chiefs were “gods, fire, heat, and raging blazes, and they conversed with chiefs and retainers only at night”.

S. M. Kamakau, *Ka Poʻe Kahiko*, p. 4
**PPN *kainanga***
In Ancestral Polynesia, a land-holding or controlling group, exogamous, probably unilineal, tracing “ascent” from a founding ancestor.

**PEP *mata-kainanga***
Merges PPN *mata*, a vague-defined social group ("community" ?) with *kainanga*.

**HAW maka’ainana***
Commoner, populace, people in general.
PPN *\textit{kaainga} \\
In Ancestral Polynesian society, a social group controlling rights to an estate, along with the principal dwelling or house site of that estate; a residential group.

HAW ‘\textit{aina} \\
Land, earth (in general).
PPN *qariki
In Ancestral Polynesia, the senior, male, titled leader of the *kainanga social group, who inherited his position patrilineally within the senior ranked line of this group, and who acted as the group’s secular as well as ritual leader.

HAW ali’i
Chief, chiefess, ruler.

HAW moi
King. An innovation in Hawaiian social terminology (not a retention from PPN).
Population growth: An “ultimate” factor in the transformation of Hawaiian society

In 1779, Captain James Cook was greeted by immense crowds at Kealakekua Bay. Lt. King, based on careful consideration of village size and area of shoreline, estimated the archipelago-wide population at 400,000. Recent archaeological work suggests King’s estimate may be close to reality.
Hawaiian population grew from small founding propagule to ~500,000+ over 800 years

Site frequency growth curve based on data from Hommon, Cordy, and additional dated sites. N=170 sites from West Hawai‘i Island

Frequency distribution of 000 radiocarbon dates from throughout the Hawaiian Islands indicates exponential growth rate from A.D. 800-1400.

Dye and Komori (1992) *New Zealand Journal of Archaeology*, fig. 3
Intensification of dryland agricultural systems in Hawaii constrained by biogeochemical gradients.

Nutrient status of a particular substrate is a function of age and rainfall. Hence, dryland field systems were restricted to younger islands of Hawai‘i and Maui.
Beginning around A.D. 1200, a major phase of agricultural expansion and intensification commenced.

Agricultural systems included pondfield irrigation (for taro) on the geologically older islands with suitable water sources, and dryland field systems (for sweet potato and taro) on leeward slopes.

Radiocarbon dates bracket the time period of this major phase of agricultural development.

Irrigation systems constructed in windward valleys beginning in the 13th century

Waikolu Valley, Moloka’i—14C date indicates 13th century construction of fields.

Beta-153426
770 +/- 40 BP
A.D. 1240-1280
Pondfield irrigation systems expanded over valley bottoms and coastal plains

By late prehistory, extensive systems of irrigated pondfields, fed by streams, springs, and seeps had been constructed throughout the valleys and suitable coastal plains of the islands.

The geologically older islands (West Maui to Kaua‘i) were particularly suited to this kind of landesque capital intensive agriculture.

These systems permanently modified valley landscapes, changing vegetation, topography, and hydrology.

Taro pondfields in various stages of cultivation at Keanae, Maui. Photo by P. V. Kirch.
Highly intensive forms of agricultural production underwrote the Hawaiian political economy.

Cumulative $^{14}$C probability distributions for windward and leeward agricultural sites on several islands.

Irrigated terraces for pondfield cultivation of taro, in Nualolo ‘Aina Valley, Kaua‘i Island.

Stone-walled fishpond for mullet and milkfish production, Moloka‘i Island.
Kohala Field System

- Gridwork of field walls and trail boundaries
- Covers >55 km²
- Archaeologically mapped using remote sensing combined with on-terrain GPS mapping of selected areas
Kohala Field System

Photo T. Hunt
Kohala: Intensification over time

- Temporal trends in agricultural intensification can be tracked through area of land in field system, and wall density.

- Trends in Kahua show steady intensification over a period from ca. A.D. 1200-1800.

![Graph showing area A: Kahua 1 with trend lines for % of walls and % of land across phases P1 to P4.](image-url)
0 50 Meters
Charcoal samples under field walls provide $^{14}$C chronology for the field system. The relative wall sequence chronology for the field system can now be calibrated to an “absolute” chronology. The field system was developed from ca. cal A.D. 1400 until the early post-contact period.

Oxcal plot of probability distributions for series of $^{14}$C dates from the Kahua region of the Kohala field system.
Nutrient status in relation to intensification in the Kohala field system

Soil samples from under field walls (i.e., non-cultivated) were contrasted with samples from the middle of field plots.

Results show significant declines in nutrient status (remaining P shown in this graph).

Intensification therefore had a cumulative negative effect on soil fertility and agricultural production.
Preliminary conceptual model for linking agricultural production, demography, and sociopolitical organization in the Hawaiian systems.
Rise of expansive polities in late prehistory was accompanied by major investments in monumental architecture, correlated with the development of specialized religious cults.

Artist's reconstruction of the luakini war temple of Pu‘u Kohola, Hawai‘i Island. (Painting by H. K. Kane)

Radiocarbon dates associated with religious and habitation sites.
**230Th High-Precision Dating of Branch Coral Offerings on Temple Sites**

Application of 230Th method allows us to date dedicatory offerings on temple sites to a high degree of precision: +/- 10 years at 2 standard deviations.

**Table 2.** 230Th/U dates for archaeological and modern corals

<table>
<thead>
<tr>
<th>Sample</th>
<th>coral habit</th>
<th>Sample wt (mg)</th>
<th>U ppm</th>
<th>230Th pg/g</th>
<th>232Th/230Th</th>
<th>233U x 10^6</th>
<th>233U x 10^6</th>
<th>234U x 10^6</th>
<th>Date* (yr)</th>
<th>Corrected Date* (yr)</th>
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</thead>
<tbody>
<tr>
<td>Kawela 1-A</td>
<td>branch fragment</td>
<td>1050.1</td>
<td>2.86</td>
<td>600</td>
<td>67.6</td>
<td>6.911</td>
<td>1.18</td>
<td>4.669</td>
<td>1.55</td>
<td>1.1453 ± 0.44</td>
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<tr>
<td>Kawela 1-B</td>
<td>branch fragment</td>
<td>928.4</td>
<td>2.84</td>
<td>573</td>
<td>71.2</td>
<td>6.657</td>
<td>0.68</td>
<td>4.741</td>
<td>0.78</td>
<td>1.1493 ± 0.35</td>
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<tr>
<td>Kawela 2</td>
<td>branch tip</td>
<td>1077.4</td>
<td>2.43</td>
<td>327</td>
<td>106.4</td>
<td>4.431</td>
<td>0.91</td>
<td>4.713</td>
<td>1.19</td>
<td>1.1459 ± 0.31</td>
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<tr>
<td>Auwahi</td>
<td>branch fragment</td>
<td>1036.1</td>
<td>3.17</td>
<td>314</td>
<td>119.9</td>
<td>3.262</td>
<td>0.73</td>
<td>3.911</td>
<td>1.02</td>
<td>1.1443 ± 0.18</td>
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<tr>
<td>Kipapa</td>
<td>branch tip</td>
<td>1028.3</td>
<td>2.90</td>
<td>261</td>
<td>139.2</td>
<td>2.964</td>
<td>0.83</td>
<td>4.126</td>
<td>1.30</td>
<td>1.1475 ± 0.31</td>
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<tr>
<td>MA 275</td>
<td>branch fragment</td>
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<td>2.43</td>
<td>224</td>
<td>133.5</td>
<td>3.031</td>
<td>0.39</td>
<td>4.048</td>
<td>1.23</td>
<td>1.1463 ± 0.17</td>
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<tr>
<td>MAW 255</td>
<td>branch tip</td>
<td>920.5</td>
<td>3.35</td>
<td>380</td>
<td>108.1</td>
<td>3.736</td>
<td>0.42</td>
<td>4.038</td>
<td>1.35</td>
<td>1.1504 ± 0.17</td>
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<tr>
<td>Naka 405</td>
<td>branch tip</td>
<td>935.8</td>
<td>2.77</td>
<td>390</td>
<td>91.7</td>
<td>4.640</td>
<td>0.57</td>
<td>4.254</td>
<td>0.90</td>
<td>1.1444 ± 0.31</td>
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<tr>
<td>Naka 405</td>
<td>8 cm from branch tip</td>
<td>1024.8</td>
<td>3.14</td>
<td>279</td>
<td>147.2</td>
<td>2.922</td>
<td>0.35</td>
<td>4.300</td>
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<td>1.1488 ± 0.23</td>
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<td>Naka 414</td>
<td>colony-base fragment</td>
<td>1006.9</td>
<td>2.36</td>
<td>106</td>
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<td>1.487</td>
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<td>2.57</td>
<td>145</td>
<td>241.6</td>
<td>1.860</td>
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<td>1.1469 ± 0.19</td>
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<td>Modern</td>
<td>branch tip</td>
<td>1002.5</td>
<td>3.21</td>
<td>366</td>
<td>3.1</td>
<td>3.752</td>
<td>0.56</td>
<td>0.116</td>
<td>12.00</td>
<td>1.1457 ± 0.17</td>
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</tbody>
</table>

a A and B are replicate samples obtained by splitting 2 g of coral.

b All isotopic ratios are activity ratios, unless otherwise specified.

c All errors are given as 95% confidence intervals.

d Date not corrected for 230Th non-radiogenic (230Thnr). Errors are analytical errors only.

e Date corrected for initial Th using a ratio of (230Thnr/232Th) atomic = 1.2 x 10^-5, as determined from analysis of living coral; initial Th ratio is assigned an error of ± 50%, which is propagated into final date-errors.

f Modern coral was collected in July 2002 and analyzed in December 2003.

Decay constants used are those of Cheng et al. (2000).
Imposition of ritual control hierarchy in Kahikinui indicated by rapid development of temple system

- A system of temples was emplaced over the Kahikinui landscape between A.D. 1580-1640, as determined by high precision $^{230}$Th dating of branch coral offerings.
- This temple system is the material manifestation of an elite control hierarchy.
- System was imposed ca. 200 years after initial settlement of the landscape, but prior to maximum population peak.

Painting by Herb K. Kane

Artist’s reconstruction of a stone temple platform under construction.
Imposition of Kahikinui temple system may correspond with establishment of ‘archaic state’ ca. A.D. 1570-1630

According to Hawaiian traditions, Pi’ilani, followed by his grandson Kamalalawalu, expanded the West Maui chiefdom to form a new polity encompassing 2,360 square kilometers.

Location of Pi’ilani’s major war temple at Hana.
Implication for Hawaiian cultural evolution: Did limits to agricultural expansion and intensification lead to aggressive territorial expansion?

Limits to intensification, coupled with decreasing yields and ability of elites to extract surpluses, may have fueled the aggressive territorial expansion noted for contact-period Hawai’i by ethnohistorians.

Model of possible links between population, intensification, and territorial expansion. (from Kirch 1984)

Artist’s reconstruction of Hawaiian naval warfare

H. K. Kane
Proximate causation: chiefly agency

Population growth, agricultural intensification across nutrient limited landscapes, and stochastic variation in rainfall are all likely to be important ultimate causes, but the role of individual agency as proximate cause is equally important.

Genealogy of the chiefly lines of Hawai‘i Island showing marriage alliances, and consolidation of smaller polities into emerging archaic state in late prehistory.