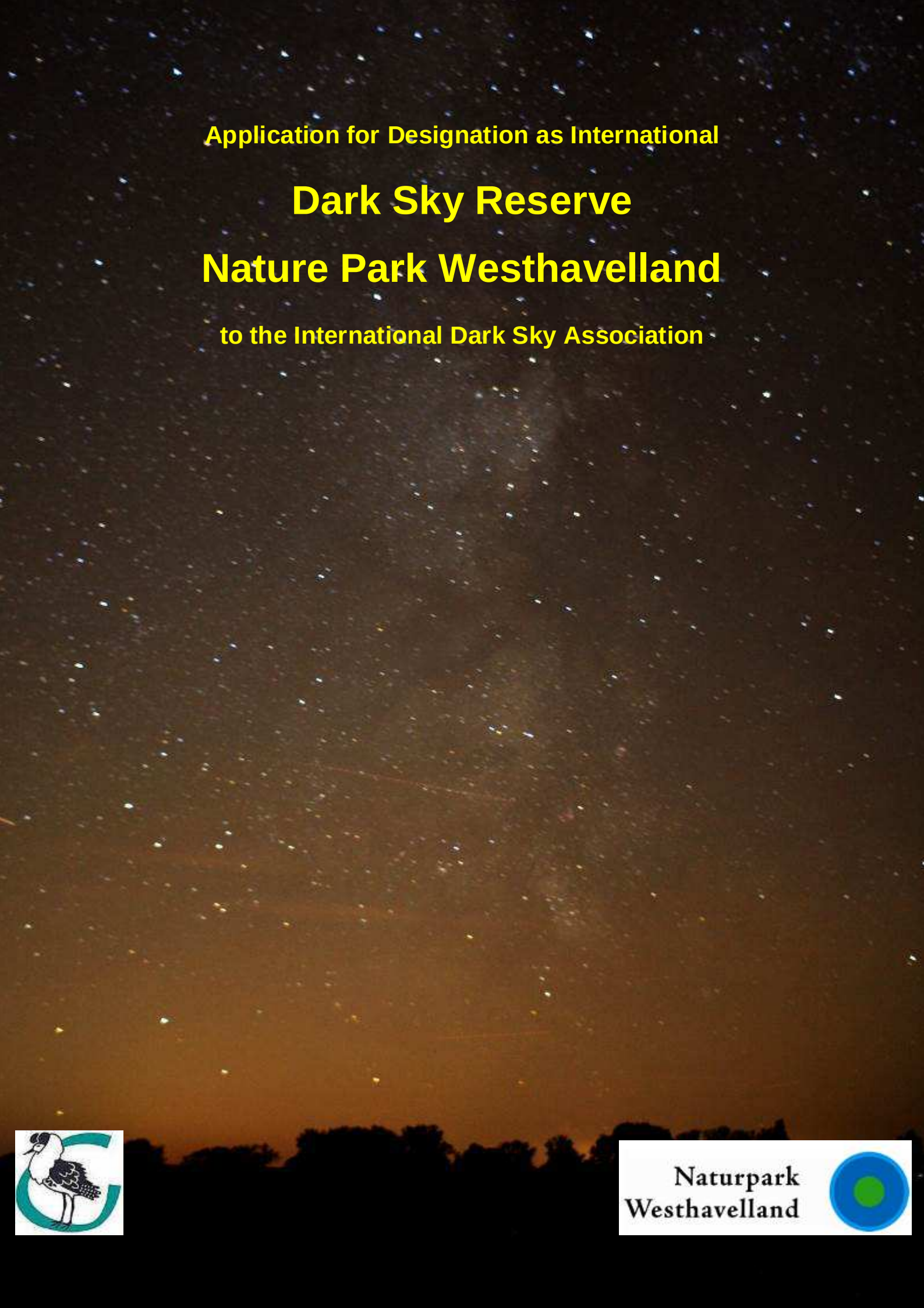


Application for Designation as International

Dark Sky Reserve

Nature Park Westhavelland

to the International Dark Sky Association

Naturpark Westhavelland

Content

Star party in 2011 in the nature park Westhavelland

This study has been prepared by *Andreas Hänel*, planetarium Osnabrück, with the help of *Claudia Hesse* and *Kordula Isermann* Nature Park Westhavelland. We thank *Josiane Meier* for her critical commentary.

Pictures are - if not otherwise mentioned - from *A. Hänel*

1 Summary

The nature park Westhavelland situated about 70 km west of Berlin is an important resting area for migrating birds. It offers very dark skies not too far from the bright metropolitan region of the German capital with about 4.4 million people, though it is with about 60 inhabitants/km² more densely populated compared to already recognized International Dark Sky Places. Therefore the concept of an International Dark Sky Reserve is very well suited to this situation, as still existing dark areas shall be protected by adapting the light in the scattered villages around. This could become a showpiece for densely populated protected areas in central Europe.

The nature park administration is convinced that becoming an International Dark Sky Reserve (IDSR) will help:

- to keep the sky and natural environment in the park dark
- to conserve dark sky areas in the region and even in the whole nation
- to raise awareness for environmental friendly and sustainable lighting in the park and to set up examples for other populated regions
- to propagate dark sky and sustainable tourism in the park and elsewhere.

To accomplish these goals, the following steps have been taken:

1. Since 2010 sky brightness measurements were taken to identify the dark areas. Variations during different times of the night and during the seasons were taken into account and since 2012 also continuous annual records have been taken (chapter 5).

2. A lighting inventory (more than 11300 luminaires) was made to describe the lighting situation in the settlements and to identify the different contributors to the artificial sky brightness (chapter 6).

3. The darkest area was identified as a possible core zone (Zone E0). It is under nature protection and has no artificial lighting. Buffer areas (zones E1 and E2) were defined where lighting should be regulated to protect the core areas (chapter 7). The councils of nearly all communities officially voted to support the application of the nature park becoming a star park.

4. In 2010 and 2011 the councils of many communities of the nature park voted to support the application as a “Dark Sky Park” and adopted to follow lighting guidelines that were not yet formulated in detail. Detailed guidelines were drawn up since 2012 for managing artificial light to keep the core areas dark and reduce light pollution in the villages and cities of the buffer zones (chapter 8). They are based on the International Dark Sky Reserve guidelines, version 1.2 (March 2008), the Guidelines for Outdoor Lighting of RASC, the Starlight Reserve Recommendations and recent scientific publications. The councils as managing bodies of all villages in the core and buffer zone E1 formally adopted these guidelines for all future installations and replacements of public lighting. In the outer buffer zone E2 some towns have adopted the lighting guidelines, others are still in the process of voting on the guidelines.

5. The nature park administration and rangers are well-versed in astronomy and light pollution, several amateur astronomers observe the dark skies of the nature park. A yearly star party, the WHAT (Westhavelländer Astronomietreffen) attracts amateurs from the whole country and people from the region. Interest in dark sky tourism to the region is increasing. Information material has been produced to publicize the star park and an exhibition has been installed in the visitor’s center. The idea of a first “star park” (a term that is preferred instead of dark sky reserve) being established in Germany has already received considerable media coverage in regional and national newspapers, magazines, radio and tv stations – especially during the star party in 2013 (chapter 9).

A designation of the nature park Westhavelland as an International Dark Sky Reserve would be an essential accelerator for the protection of a natural dark sky in one of the darkest regions of Germany by securing the installation of an environmental friendly and sustainable artificial lighting in the settlements. This process and its success will continue to be monitored during the next years.

The nature park administration, the administrations and councils of the municipalities strive to protect the nighttime environment just as they protect the daytime environment and therefore support the mission and goal of the International Dark Sky Association IDA.

2 Nomination

Fachgruppe DARK SKY - Initiative gegen Lichtverschmutzung

www.lichtverschmutzung.de

Vereinigung VdS der Sternfreunde e.V.

A. Hänel, Am Sportplatz 7, D-49124 Georgsmarienhütte

International Dark-Sky Association
IDA Board of Directors
3223 N. First Avenue
Tucson, Arizona 85719
USA

Geschäftsstelle
Postfach 1169
64629 Heppenheim
Telefon 06252/787154
Telefax 06252/787220
service@vds-astro.de

Leader of the working group
Dr. Andreas Hänel
Am Sportplatz 7
D-49124 Georgsmarienhütte
Email: ahaenel@uos.de

November 20th, 2013

Dear IDA Board of Directors,

I would like to nominate the nature park Westhavelland as an International Dark Sky Reserve.

The maps of the atlas of light pollution (Cinzano et al., 2000) show the region of northeastern Germany as one of the darkest regions in Central Europe. First measurements of the sky brightness in April 2009 confirmed an almost natural dark sky in the nature park Westhavelland. Therefore I proposed to the nature park administration to consider working towards dark sky designation. In May 2010 I could present the idea to the nature park's Board of Trustees and all members as representatives of different groups of the society agreed unanimously to pursue a designation. During several observing campaigns, further measurements with identical instrumentation and all-sky photos were taken.

In comparison with observations in many other well-known dark sky places of Europe, these confirm the exceptional night sky quality in the nature park. Also with regard to the extraordinary wildlife of the park, a conservation of the dark night environment is essential. Many areas in the northwestern part of the park still have no artificial lighting. The political representatives of the small villages dispersed in this part of the park have demonstrated their support for the protection of their dark skies by taking formal decisions to reduce any upward lighting in the future. This shows that the will to support the idea first of a dark sky park and then a dark sky reserve is very strong. The park administration is working closely with the communities on this ongoing process, intensifies the public awareness of the necessity of the dark night environment and recommends how to reduce light pollution.

Therefore I recommend that IDA grants the Nature Park Westhavelland the title of an International Dark Sky Reserve.

Dr. Andreas Hänel

Astronomer and director of the planetarium in the Museum am Schölerberg, Osnabrück
Section leader of the working group Dark Sky Germany,
Member of the International Dark Sky Association IDA, Member of the International Planetarium Society IPS, Member of the Astronomische Gesellschaft, Member of the International Astronomical Union IAU

Museum am Schölerberg,
Klaus-Strick-Weg 10, D-49082 Osnabrück
Germany, ahaenel@uos.de

3 Letters of Support

Superintendent of the Nature Park

LAND BRANDENBURG

Landesamt für Umwelt, Gesundheit und Verbraucherschutz
Abteilung Großschutzgebiete, Regionalentwicklung

Landesamt für Umwelt, Gesundheit und Verbraucherschutz
Postfach 60 10 61 | 14410 Potsdam

IDA, International Headquarters
3223 N. First Avenue
Tucson, Arizona 85719
USA

Naturpark Westhavelland

Bearb.: Kordula Isermann
Gesch-Z.:
Hausruf: 033872-743-14
Fax: 033872-743-12
Internet: www.lugv.brandenburg.de
Kordula.isermann@lugv.brandenburg.de

Parey, 07. November 2013

Letter of Nomination of Naturpark Westhavelland

Dear IDA Board of Directors,

as the superintendent of Westhavelland Nature Park I strongly endorse the application for International Dark Sky Reserve designation and I support all efforts to preserve the quality of our night sky.

Even though the communities of the Nature Park Westhavelland struggle with several structural problems they join in the vision that dark nights are precious und worth to be protected. That is of special attention because it needs to have the guts to stand up for a dark night sky in Eastern Germany – the former so called "Dunkel Deutschland (Dark Germany). Dealing responsible with energy and light is put on a level with underdevelopment and insecurity still to often.

I am confident that honoring Westhavelland Nature Park as a Dark-Sky-Reserve will have a considerably impact of the Nature Park and well beyond its borders.

The Designation would be an honor and a long lasting commitment for the Westhavelland region.

Yours sincerely

Kordula Isermann
Westhavelland Nature Park Superintendent

Dienstsitz:
Seeburger Chaussee 2
14476 Potsdam
OT Groß Glienicke

Besucheranschrift:
Pareyer Dorfstraße 5
14715 Havelaue
Tel: 033872 - 743-0
Fax: 033872 - 743-12

QUALITÄTS NATURPARK

Deputy Administrator tourism, education and public relation of the Nature Park

LAND BRANDENBURG

Landesamt für Umwelt, Gesundheit und Verbraucherschutz
Abteilung Großschutzgebiete, Regionalentwicklung

Landesamt für Umwelt, Gesundheit und Verbraucherschutz
Postfach 60 10 61 | 14410 Potsdam

IDA, International Headquarters
3223 N. First Avenue
Tucson, Arizona 85719
USA

Naturpark Westhavelland

Bearb.: Claudia Hesse
Gesch-Z.:
Hausruf: 033872-743-15
Fax: 033872-743-12
Internet: www.lugv.brandenburg.de
Claudia.Hesse@lugv.brandenburg.de

Parey, 07. November 2013

Letter of Nomination of Naturpark Westhavelland

Dear IDA Board of Directors,

as the administrator of tourism, education and public relation at the Westhavelland Nature Park, I support and encourage the creation of an IDA Dark Sky Park in our region.

Yours faithfully

C. Hesse

Claudia Hesse
Deputy Administrator tourism, education and public relation

Dienstsitz:
Seeburger Chaussee 2
14476 Potsdam
OT Groß Glienicke

Besucheranschrift:
Pareyer Dorfstraße 5
14715 Havelaue
Tel: 033872 - 743-0
Fax: 033872 - 743-12

QUALITÄTS NATURPARK

State Secretary of the Ministry for Environment, Health and Consumer Protection (as head of the Nature Park)

LAND BRANDENBURG

Ministerium für Umwelt, Gesundheit und Verbraucherschutz
Die Staatssekretärin

Heinrich-Mann-Allee 103
14473 Potsdam

Hausruf: 0331 866 7004
Fax: 0331 866 7006
Internet: www.mugv.brandenburg.de

Ministerium für Umwelt, Gesundheit und Verbraucherschutz des Landes Brandenburg
Postfach 601150 | 14411 Potsdam

IDA, International Headquaters
3223 N. First Avenue
Tuscon, Arizona 85719
USA

Potsdam, den 23. Oktober 2013

**Bewerbung des Naturparks Westhavelland als „Dark Sky Reserve"
bei der International Dark-Sky Association (IDA)**

Sehr geehrte Damen und Herren,

das Ministerium für Umwelt, Gesundheit und Verbraucherschutz (MUGV) hat als Zielstellung den Erhalt der Umwelt, die Förderung der Gesundheit und die Stärkung des Verbraucherschutzes im Land Brandenburg.

Neben den ökonomischen Vorteilen einer intelligenten und bedarfsorientierten Beleuchtung, unterstützen die Prinzipien der IDA die Schutzbemühungen des Naturparks und seinen Auftrag zur Förderung der nachhaltigen, naturverträglichen Erholung und Umweltbildung in besonderer Weise.

Ich bin überzeugt, dass die Auszeichnung des Naturparks Westhavelland als Sternenpark (Dak-Sky-Reserve) auch eine Ausstrahlungswirkung weit über die Naturparkgrenzen haben wird. Durch das nur ca. 70 km entfernte Berlin hat der Sternenpark Westhavelland die Chance das Schutzgut „Nachthimmel" für Menschen der Metropole direkt und einfach erlebbar zu machen.

Der Naturpark Westhavelland ist Teil meines Geschäftsbereichs, sein Engagement und das seiner Kommunen und Partner für den Erhalt des natürlichen Nachthimmels und die Wiederentdeckung des Nachthimmels als schützenswertes Kulturgut wird seitens des MUGV weiter unterstützt.

Das MUGV begrüßt die Bewerbung des Naturparks Westhavelland für den Titel „Sternenpark" („Dark Sky Reserve") ausdrücklich.

Mit freundlichen Grüßen

Almuth Hartwig-Tiedt

Translation:

Application of the Nature Park Westhavelland as Dark Sky Reserve of the International Dark Sky association (IDA)

Dear Sir or Madam,

The aim of the Ministry for Environment, Health and Consumer Protection (MUGV) is to protect the environment, to promote health and the consumer protection in the state of Brandenburg.

Besides the economic advantages of an intelligent and responding to the demand illumination, the principles of IDA particularly support the nature park's efforts of protection of and the commission of sustainable, nature friendly recreation and environmental education.

I am convinced that the designation of the nature park Westhavelland as Star Park (International Dark Sky Reserve) will have a far reaching effect beyond the boundaries of the nature park. As Berlin is just 70 km away, a star park Westhavelland would offer the chance that a protected night sky could be experienced directly and easily by the inhabitants of the metropolitan region.

The nature park is part of my division, its engagement and the engagement of its communities and partners for protecting the natural night sky and rediscovery of the night sky as an estimable cultural asset is supported by the MUGV.

The MUGV welcomes the application of the nature park Westhavelland to become a "star park" (International Dark Sky Reserve) explicitly.

With kind regards

Almuth Hartwig-Tiedt
State Secretary

The state secretary during her visit at the WHAT 2013

State Secretary of the Ministry for Science, Research and Culture

LAND BRANDENBURG

Ministerium für Wissenschaft, Forschung und Kultur
Der Staatssekretär

Dortustraße 36
14467 Potsdam

Hausruf: (0331) 866 4557
Fax: (0331) 866 4554
Internet: www.mwfk.brandenburg.de
martin.gorholt@mwfk.brandenburg.de

Ministerium für Wissenschaft, Forschung und Kultur des Landes Brandenburg | Postfach 60 11 62 | 14411 Potsdam

IDA, International Headquaters
3223 N. First Avenue
Tuscon, Arizona 85719
USA

Potsdam, 18. Oktober 2013

Bewerbung des Naturparks Westhavelland als „Sternenpark“ bei der International Dark-Sky Association (IDA)

Sehr geehrte Damen und Herren,

das Ministerium für Wissenschaft, Forschung und Kultur (MWFK) ist verantwortlich für die Pflege und Förderung von Wissenschaft und Kultur im Land Brandenburg.

Mit großem Interesse und Wohlwollen verfolgt das MWFK die Bemühungen des Naturparks Westhavelland und seiner Kommunen um die Vermeidung von Lichtverschmutzung und Wiederentdeckung des Nachthimmels als schützenswertes Kulturgut.

Mit den Arbeiten der Hochschule für nachhaltige Entwicklung in Eberwalde (HNE) als Einrichtung in unserem Geschäftsbereich ist das MWFK bereits Teil der Bewegung. Ein weitergehendes Engagement im Bereich Forschung und Bildung liegt auch in meinem Interesse.

Das MWFK begrüßt die Bewerbung des Naturparks Westhavelland für den Titel „Sternenpark“ („Dark Sky Reserve“).

Mit freundlichen Grüßen

Martin Gorholt

WO preußen sachsen küsst
www.brandenburgische-landesausstellung.de

Dok.-Nr.:2013/056858

Die genannte eMail-Adresse dient nur für den Empfang einfacher Mitteilungen ohne Signatur und / oder Verschlüsselung.

Translation:

Application of the Nature Park Westhavelland as Dark Sky Reserve of the International Dark Sky association (IDA)

Dear Sir or Madam,

The Ministry for Science, Research and Culture (MWFK) is responsible for the care and promotion of sciences and culture in the state of Brandenburg.

With great interest and goodwill the MWFK follows the effort of the nature park Westhavelland and its communities to reduce light pollution and the rediscovery of the night sky as an estimable cultural asset.

The University for Sustainable Development Eberswalde as part of our division already participated in the application process with some student's theses. Further engagement in research and education is also of my particular interest.

The MWFK welcomes the application of the nature park Westhavelland to become a "star park" (International Dark Sky Reserve) explicitly.

With kind regards

Martin Gorholt
State Secretary

In 2012 *Martin Gorholt*, State Secretary Ministry for Science, Research and Culture Brandenburg, officially opened the WHAT 2012 (photo: *Bardenhagen*).

Landkreis (county) Havelland

Landkreis Havelland
DER LANDRAT

Landkreis Havelland, Platz der Freiheit 1, 14712 Rathenow
Postanschrift: **Landkreis Havelland, Postfach 1352, 14703 Rathenow**

IDA
International Headquaters
3223 N. First Avenue
Tuscon, Arizona 85719
USA

Auskunft erteilt:			
Herr Dr. Kellner			
E-Mail***			
regina.lanz@havelland.de			
Telefonvermittlung	Telefax	Durchwahl	Zimmer
03385/551-0	03385/551-4465	551-4400	316

Datum und Zeichen Ihres Schreibens	Mein Zeichen/Aktenzeichen (Bitte stets angeben!)	Datum
	III	7 .11.2013

Bewerbung des Naturparks Westhavelland als „Sternenpark"
bei der International Dark-Sky Association (IDA)

Sehr geehrte Damen und Herren,

der Landkreis Havelland ist ein attraktiver und aufgeschlossener Teil der Metropolregion Berlin-Brandenburg. Seine Verwaltung nimmt Einfluss darauf, dass sein kostbarer Natur- und Kulturraum bewahrt sowie kreativ und nachhaltig genutzt werden kann.

Der Landkreis Havelland begrüßt die Bewerbung des Naturparks Westhavelland für den Titel „Sternenpark" („Dark Sky Reserve"). Die Vermeidung von Lichtverschmutzung dient dem Klima- und Naturschutz und ist ökonomisch sinnvoll. Die Wiederbelebung der Wahrnehmung des Nachthimmels birgt Chancen für den naturverträglichen Tourismus und leistet einen wertvollen Beitrag zur kulturellen Bildung.

Die Bewerbung des Naturparks Westhavelland für den Titel „Sternenpark" der IDA hat meine volle Unterstützung.

Mit freundlichen Grüßen

in Vertretung

Dr. Kellner
Zweiter Beigeordneter

*** Die genannte E-Mail Adresse dient nur für den Empfang einfacher Mitteilungen ohne Signatur und/oder Verschlüsselung.

Sprechzeiten: Montag geschlossen
Dienstag 09.00 - 12.00 Uhr
15.00 - 18.00 Uhr
Mittwoch geschlossen
Donnerstag 09.00 - 12.00 Uhr
Freitag 09.00 - 12.00 Uhr

Konto der Kreiskasse
Mittelbrandenburgische Sparkasse in Potsdam
Konto-Nr.: 386 101 48 30
BLZ: 160 500 00
IBAN: DE 33160500003861014830
BIC: WELADED1PMB

Translation

Application of the nature park Westhavelland as “International Dark Sky Reserve” (Sternenpark) with the International Dark Sky Association (IDA)

Dear Sir or Madam,

,

The Landkreis (county) Havelland is an attractive and open-minded part of the metropolitan region Berlin-Brandenburg. Its administration influences, that its precious nature and culture areas are protected and used in a creative and sustainable manner.

The Landkreis Havelland welcomes the application of the nature park Westhavelland for the title “Sternenpark” (International Dark Sky reserve). The avoidance of light pollution serves the climate and nature protection and makes sense for ecology. The recovery of the perception of the night sky holds chances for environmental friendly tourism and makes a valuable contribution to a cultural education.

I strongly support the application of the nature park Westhavelland for the title “International Dark Sky Reserve” of the IDA,

With kind regards,

Dr. Kellner
2nd councillor

NABU regional nature protection society

NABU RV Westhavelland • Stremmestraße 10 • 14715 Milower Land

IDA,
International Headquaters
3223 N. First Avenue
Tucson, Arizona 85719

USA

NABU
RV Westhavelland

Tino Wachowiak
1. Vorsitzender

Telefon: 03386 / 211166
Telefax: 03386 / 211235
E-Mail: nabu@rathenow.de

Milow, den 22. Oktober 2013

Bewerbung um Dark Sky Reserve Naturpark Westhavelland

Sehr geehrte Damen und Herren der IDA,

der NABU RV Westhavelland e.V. verfolgt mit großem Interesse und eigenen Anstrengungen die neue und qualifizierte Bewerbung Naturparks Westhavelland und seiner Kommunen für den Titel Dark Sky Reserve der IDA.

Der Aufenthalt in der Natur in Verbindung mit dem Erleben einer Vielzahl von Eindrücken, von Geräuschen und Beobachtungen in der Nacht, sind dabei ein Schlüssel des Naturerlebens in unserer Region. Für die Wiederentdeckung des Lebensraums „Nacht" haben wir uns durch die Erweiterung unserer Ausstellung mit einem „Sternenzelt" bereits in diese Richtung neu aufgestellt.

Durch die gezielte Ausbildung von Natur und Landschaftsführern in unserem Naturpark, haben wir die Grundlage geschaffen, Bildung für nachhaltige Entwicklung gezielt anzubieten, dazu zählt inzwischen auch die Vermittlung der Schönheit des nächtlichen Sternenhimmels mit seiner beeindruckenden Geräuschkulisse.

Wir sehen die Aktivitäten der Naturparkverwaltung und seiner Kommunen zum Schutz des dunklen Nachthimmels als weiteren Beitrag zum Erhaltes einer lebenswerten Umwelt in Verbindung mit der Stärkung des regionalen naturverträglichen Tourismus im ländlichen Raum mit Metropolenanbindung.

Wir werden mit unserem Fachwissen und unseren Aktionen die Ziele des Sternenparks unterstützen und stehen der Naturparkverwaltung bei der Umsetzung dicht zur Seite.
Die Bewerbung des Naturparks für den Titel „Dark Sky Park" findet unsere vollste Zustimmung.

Mit freundlichen Grüßen,
Tino Wachowiak

Naturschutzbund Deutschland
Regionalverband Westhavelland
Stremmestraße 10
14715 Milower Land, OT Milow
Telefon 03386/211166
Telefax 03386/211365
E-Mail: NABU@Rathenow.de

Bankverbindung
MBS Potsdam
BLZ 160500 00
Konto-Nr. 3853 132 102

Naturparkzentrum
Träger des
Naturparkzentrums Westhavelland
in Milow

Anerkannter Naturschutzverband
Der NABU nimmt als anerkannter Naturschutzverband nach §29 Bundesnaturschutzgesetz Stellung zu naturschutzrelevanten Planungen.

Translation

Application for International Dark Sky Reserve Westhavelland

Dear Sir or Madam of IDA,

The NABU RV Westhavelland e.V. follows with great interest and own efforts the new and qualified application of the nature park Westhavelland and its communities for the title of an International Dark Sky Reserve of IDA.

The stay in nature in connection with the experience of many impressions, of sounds and observations during night are a key experience in our region. To rediscover the habitat “night” we installed a “star tent” during the expansion of the exhibition (in our visitors center).

Through the specific instruction of nature and landscape rangers in our nature park, we created the basis to offer an education for sustainable development, part of it being to communicate the beauty of the starry night sky with its impressive background sound.

We judge the activities of the nature park administration and their communities to protect the dark night sky as a further contribution to maintain a livable environment in connection with a strengthening of the regional nature friendly tourism in a rural region close to a metropolitan area.

We will support the aims of a star park with our specialist knowledge and our actions and we support the nature park administration with the implementation.

The application of the nature parks for the title “International Drak Sky reserve” is fully supported by us.

With kind regards,

Tino Wachowiak

Tourism Federation of the State of Brandenburg

Landestourismusverband Brandenburg e.V. · Fischbänkenstr. 8 · 16816 Neuruppin

IDA, International Headquaters
3223 N. First Avenue
Tuscon, Arizona 85719
USA

Landestourismusverband Brandenburg e.V.

Fischbänkenstraße 8
16816 Neuruppin

Bearbeiter: Peter Krause

Telefon: 03391 - 40 26 00
Fax: 03391 - 40 26 33
E-Mail: krause@ltv-brandenburg.de
Internet: www.ltv-brandenburg.de

Dienstag, 5. November 2013

Application by Nature Park Westhavelland for „Dark Sky Reserve" at International Dark-Sky Association (IDA)

Dear Sir or Madam,

the Tourism Federation of the State of Brandenburg is gathering the regional tourism organisations of the whole state to represent their interests and promote the touristic development in the state.

"Discover new prospects." With these words Brandenburg welcomes its guests at its borders. The discovery und enjoyment of the night sky is such new prospect. The Tourism Federation endorses the efforts of the communities and the nature park to expand their touristical range.

The accreditation as „Dark Sky Reserve" would reward the efforts of the participants and function as a flagship for the fight against light-pollution.

The Tourism Federation of the State of Brandenburg strongly supports the application being made by the administration of the nature park Westhavelland for Dark Sky Reserve Accreditation.

Yours sincerely

Peter Krause
(Geschäftsführer)

Biosphere Reserve Mittelelbe

SACHSEN-ANHALT

Biosphärenreservatsverwaltung Mittelelbe • Postfach 1382 •
06813 Dessau-Roßlau

Biosphärenreservat Mittelelbe

IDA, International Headquaters
3223 N. First Avenue
Tucson, Arizona 85719
USA

Dessau, 15.11.2013

Bewerbung des Naturparks Westhavelland als „Sternenpark“ bei der International Dark-Sky Association (IDA)

Sehr geehrte Damen und Herren,

das Biosphärenreservat Mittelelbe ist direkter Nachbar des Naturparks Westhavelland. Das länderübergreifende Biosphärenreservat Flusslandschaft Elbe (Sachsen-Anhalt, Brandenburg, Mecklenburg-Vorpommern, Niedersachsen und Schleswig-Holstein) schützt seine Arten und Lebensräume, ermöglicht und entwickelt das Naturerleben und fördert die nachhaltige Nutzung seiner Landschaft.
Deshalb sind die Ziele, der IDA, die mit dem Titel „Dark-Sky-Reserve“ verbunden sind in weiten Punkten deckungsgleich.

Die Biosphärenreservatsverwaltung Mittelelbe begrüßt und unterstützt die Bewerbung des Naturparks Westhavelland für den Titel „Dark-Sky-Reserve“.

Mit freundlichen Grüßen

i.V.

Guido Puhlmann

Leiter Biosphärenreservatsverwaltung Mittelelbe

Ihr Zeichen/ Ihre Nachricht vom:

Mein Zeichen

Bearbeitet von:
Armin Wernicke

Tel.: (039389) 96783

E-Mail: armin.wernicke@bioresme.mlu.sachsen-anhalt.de

Besucheradresse:
Biosphärenreservat Mittelelbe
Am Kapenschlösschen 1
06785 Oranienbaum-Wörlitz

Tel.: (034904) 421-0
Fax: (034904) 421-21

E-Mail:
poststelle@bioresme.mlu.sachsen-anhalt.de
www.mittelelbe.com
www.gartenreich.net

Dienstgebäude Arneburg:
Breite Straße 15
39596 Arneburg

Dienstgebäude Ferchels:
Nr. 23
14715 Schollene OT Ferchels

Landeshauptkasse
Sachsen-Anhalt
Deutsche Bundesbank
Filiale Magdeburg
BLZ 810 000 00
Konto-Nr. 810 015 00

Organisation der Vereinten Nationen für Bildung, Wissenschaft, Kultur und Kommunikation

Mittelelbe
Biosphärenreservat des Programms Der Mensch und die Biosphäre seit 1979

Organisation der Vereinten Nationen für Bildung, Wissenschaft, Kultur und Kommunikation

Gartenreich Dessau-Wörlitz
Welterbestätte seit 2000

Translation

Application of the Nature Park Westhavelland as „Star Park“ (Dark Sky Reserve) at the International Dark Sky Association (IDA)

Dear Sir or Madam,

The Mittelelbe (Middle Elbe) biosphere reserve is a direct neighbour of the nature park Westhavelland. The biosphere reserve Riverlandscape Elbe incorporating several German states (Saxony-Anhalt, Brandenburg, Mecklenburg-Western Pomerania, and Schleswig-Holstein) protects its species and habitats, enables and develops the nature experience and supports the sustainable use of the landscape.

Therefore the aims of IDA followed with the “Dark Sky Reserve” are essentially the same as of the biosphere reserve.

The administration of the biosphere reserve Mittelelbe welcomes and supports the application of the nature park Westhavelland for the title “Dark Sky Reserve”.

With kind regards

Guido Puhlmann

Head of the administration of the biosphere reserve Mittelelbe

Letters of Support: IDA-Members

International Dark-Sky Association
International Headquarters
IDA Board of Directors
3223 N. First Avenue
Tucson, Arizona 85719
USA

15th of November 2013

Harald Bardenhagen
Astronomie-Werkstatt
„Sterne ohne Grenzen"
Sülzgürtel 42
50937 Köln
GERMANY
haraldba@sterne-ohne-grenzen.de

Nature Park Westhavelland Application for International Dark Sky Reserve Certification

Dear IDA Board of Directors!

This letter is offered in very strong support of Nature Park Westhavelland's application for International Dark Sky Reserve status. Being one of the few IDA members in Germany I am pleased to confirm not only the famous night sky quality of the Nature Park Westhavelland but also the awesome support for a Dark Sky Reserve within the region and their people.

I had the opportunity to spend several weekends with famous observation nights under an impressive starry night sky and took part in four events for the staff of the park and three events for the citizens of the region. In addition I enjoyed to provide some support for the excursion of the participants of the ALAN 2013 conference to the Westhavelland. The three annual star-parties in 2011, 2012 and 2013 experienced a growing number of amateur astronomers and citizens, which were able to enjoy a famous dark sky in a breathtaking natural nightscape just 70 km apart from the Capital City of Berlin with more than 3.3 millions of inhabitants. This annual star party is well known across the borders of Germany as "WHAT" – the Westhavelländer Astronomie Treff. All three WHATs made a lasting impression on the star party guests in regard to the treasures and the value of the starry night sky above the park with the help of their multivarious equipment.

I watched with interest how intense the subject-matter "Starry Night Sky over Nature Park Westhavelland" already reached the hearts of the people in the region. Many discussions about light smog and better lamp fixtures and also the upcoming idea to establish local activity groups gave evidence of it. Last not least: my hostel wardens do offer courses in astronomical sketching and painting since about 18 months. And they experience a growing number of guest – for short and long visits – which are either amateur astronomers or guest keen to see the marvelous nightscape above the Lake of Gülpe.

I can definitely confirm the famous starry night sky conditions in the Westhavelland area. The Milky Way was clearly visible and I was able to see the Western and the Eastern Veil Nebula with a 25x150 binocular without any filter aid.

I am dead certain that the designation of Nature Park Westhavelland as an IDA Dark Sky Reserve will lead to a more night sky friendly approach to outdoor lighting and will be an inspiring example for other regions in Germany.

Harald Bardenhagen

Köln, 15th of November 2013

PLATFORM LICHTHINDER

Utrecht, 4-11-2013

Dear reader,
As IDA member and chairman of the Dutch organization Platform Lichthinder, which is the central point in Holland in the struggle against light pollution, I whole heartedly support the application for the Dark Sky Park Westhavelland.

I visited the region for a week, spoke with several of the central pivotal figures, doing a great job in convincing so many municipalities to reduce their light.

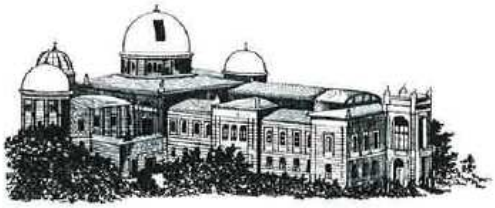
The region itself has a charm which is unique as far as I know Western Europe. Westhavelland is in daytime a rural desolated area, where the fifties still reign. In the night it is absolute devoid of any light for miles and miles, while there are no farms in the country. It is an really unique location, 70 kilometers of one of the biggest and most important towns in Europe.

With a zenithal luminance of 21.6 till 21.7, it has the same darkness as the darkest locations at the islands in the north of Holland; for these islands there are also made plans to strengthen the existing visual quality of the night.

The fact the park is populated by a number of villages which have agreed to invest in new lighting is important as an example for other municipalities and other rural areas in Europe.

The gradual widening of the park and the introduction of the proposed armatures and lights will make this a good example for other parts of Europe which would like to copy this nice and first dark sky park or reserve.

Greetings from a still largely light polluted Holland
Wim Schmidt
Chairman Vereniging Platform Lichthinder
Info@platformlichthinder.nl



University of Vienna
Department of Astrophyics

Dr. Thomas Posch
(Email: thomas.posch@univie.ac.at)

Vienna, 12th November 2013

Dear colleagues,

Since ten years, I'm working for the protection for the night sky, both as a professional astronomer and as an IDA member. With Wiley I recently published the second edition of the book "*Das Ende der Nacht*" (The End of the Night), the first edition of which has become a standard textbook on light pollution. Dark Sky Reserves are also among the topics of this book.

Therefore, I have visited a couple of places which have either already been designated as Dark Sky Reserves or have the potential to become a Dark Sky Reserve.

Among the places that I've visited in this context is the Zselic Landscape Protection Area in Hungary and – last summer – the *Naturpark Westhavelland* in Germany. The latter location impressed me strongly due to the beauty and loneliness of the landscape close to the river Elbe. Successful efforts have been made by enthusiastic individuals and by local authorities to keep light pollution at its smallest possible level and at the same time to integrate astronomy into existing outreach facilities (e.g. in the beautiful visitor centre at Milow, which has now got a mini-planetarium in one of its rooms). This results in the unique opportunity of sustainable night sky protection, especially if *Naturpark Westhavelland* would be recognized as a Dark Sky Reserve. The genuine relation between near-natural night sky brightness and undisturbed nocturnal wildlife could then be made evident to even more people than now.

Thus, I strongly support the present application and firmly believe that it could help preserving natural darkness and making accessible the beauty of the night sky to many people, both from Germany and from abroad.

Yours sincerely

Th. Posch

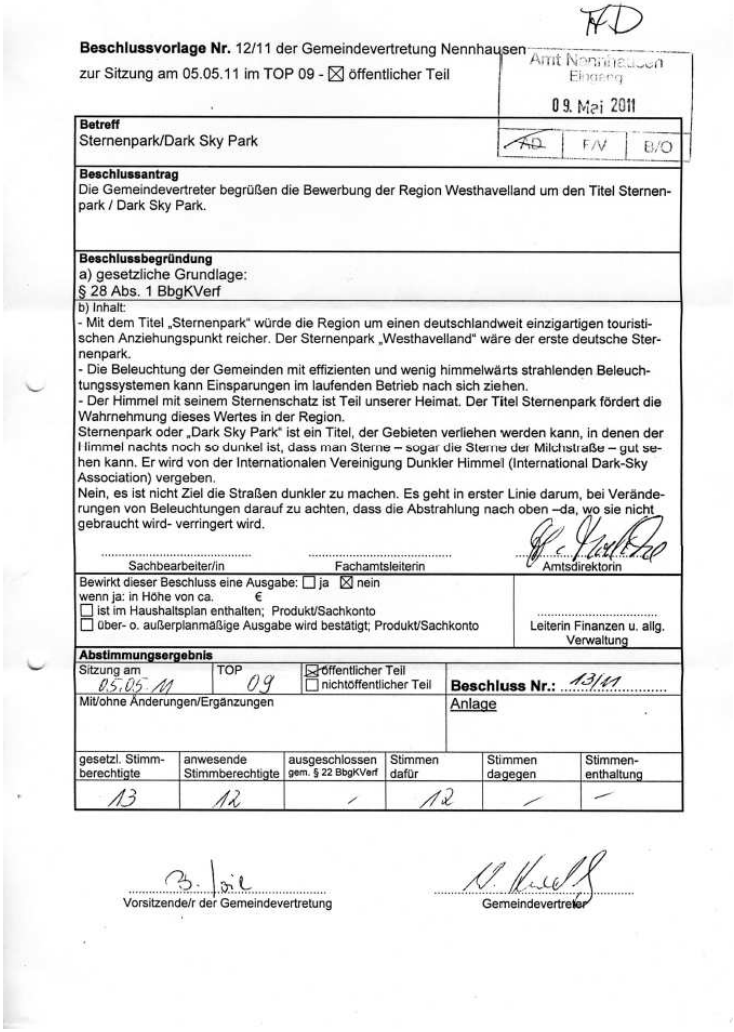
The political representatives as the governing bodies of the following villages in the Nature Park support the creation of a Dark Sky Park:

- Township Rhinow
  - o Town Rhinow
  - o Havelaue
  - o Seeblick
  - o Gollenberg
  - o Kleßen-Görne
  - o Großderschau
- Township Nennhausen
  - o Stechow-Ferchesar
  - o Kotzen
  - o Town Nennhausen
  - o Märkisch-Luch
- Township Neustadt (Dosse) with all towns
- Township Friesack
  - o Town Friesack
  - o Mühlenberge
- City Rathenow with all towns
- Milower Land with all towns
- City Premnitz with all towns
- Beetzsee (towns Beetzsee, Beetzseeheide, Päwesin, Roskow, Havelsee)

- Schollene (Sachsen-Anhalt, outside the nature park)

Not yet involved has been:
- Wusterhausen (towns Barsikow, Ganzer, Läsikow, Nackel, Seheletz)
though representatives expressed their willingness to support the project.

All official decisions are given in the appendix, the decision of Nennhausen is shown as an example here.



Beschlussvorlage Nr. 12/11 der Gemeindevertretung Nennhausen
zur Sitzung am 05.05.11 im TOP 09 - ☒ öffentlicher Teil

Amt Nennhausen Eingang 09. Mai 2011

Betreff
Sternenpark/Dark Sky Park

Beschlussantrag
Die Gemeindevertreter begrüßen die Bewerbung der Region Westhavelland um den Titel Sternenpark / Dark Sky Park.

Beschlussbegründung
a) gesetzliche Grundlage:
§ 28 Abs. 1 BbgKVerf
b) Inhalt:
- Mit dem Titel „Sternenpark" würde die Region um einen deutschlandweit einzigartigen touristischen Anziehungspunkt reicher. Der Sternenpark „Westhavelland" wäre der erste deutsche Sternenpark.
- Die Beleuchtung der Gemeinden mit effizienten und wenig himmelwärts strahlenden Beleuchtungssystemen kann Einsparungen im laufenden Betrieb nach sich ziehen.
- Der Himmel mit seinem Sternenschatz ist Teil unserer Heimat. Der Titel Sternenpark fördert die Wahrnehmung dieses Wertes in der Region.
Sternenpark oder „Dark Sky Park" ist ein Titel, der Gebieten verliehen werden kann, in denen der Himmel nachts noch so dunkel ist, dass man Sterne – sogar die Sterne der Milchstraße – gut sehen kann. Er wird von der Internationalen Vereinigung Dunkler Himmel (International Dark-Sky Association) vergeben.
Nein, es ist nicht Ziel die Straßen dunkler zu machen. Es geht in erster Linie darum, bei Veränderungen von Beleuchtungen darauf zu achten, dass die Abstrahlung nach oben –da, wo sie nicht gebraucht wird- verringert wird.

Sachbearbeiter/in | Fachamtsleiterin | Amtsdirektorin

Bewirkt dieser Beschluss eine Ausgabe: ☐ ja ☒ nein
wenn ja: in Höhe von ca. €
☐ ist im Haushaltsplan enthalten; Produkt/Sachkonto
☐ über- o. außerplanmäßige Ausgabe wird bestätigt; Produkt/Sachkonto

Leiterin Finanzen u. allg. Verwaltung

Abstimmungsergebnis

Sitzung am	TOP		
05.05.11	09	☒ öffentlicher Teil ☐ nichtöffentlicher Teil	**Beschluss Nr.:** 13/11

Mit/ohne Änderungen/Ergänzungen — Anlage

gesetzl. Stimmberechtigte	anwesende Stimmberechtigte	ausgeschlossen gem. § 22 BbgKVerf	Stimmen dafür	Stimmen dagegen	Stimmenenthaltung
13	12	-	12	-	-

Vorsitzende/r der Gemeindevertretung | Gemeindevertreter

4 Nature Park Westhavelland

4.1 Nature Protected Areas in Germany

In the following the system of protected areas in Germany will be presented in order to clarify the framework conditions for environmental protection.
Three different categories of large-scale conservation areas are designated in Germany which could potentially also protect dark night landscapes (or nightscapes) (more information on www.bfn.de, English version).

1 National Parks (Nationalparke)

The 14 national parks cover just 0.55% of the area in Germany and are areas which show little or no impact by human action. Very strict rules apply to protect nature and biodiversity free of human exploitation or intervention.

2 Biosphere reserves (Biosphärenreservate)

16 biosphere reserves cover 3.6% of the national area and preserve, develop or restore landscapes shaped by traditional diverse uses. Research and education play a central role and they are model regions for a sustainable development. An important concept to reach these goals is the use of zones of different protection levels: core, buffer and development zones.

3 Nature Parks (Naturparke)

101 nature parks cover 26% of the area of the country. They are large-scale mainly landscape protected and nature conservation areas that are intended for recreational purposes and sustainable tourism. The aim is to protect and conserve cultural landscapes with their diverse species and habitats through sustainable use of land and for purposes of recreation and nature-friendly tourism. Therefore protecting the nightscape using a sustainable artificial lighting could be one topic in the development of nature parks.

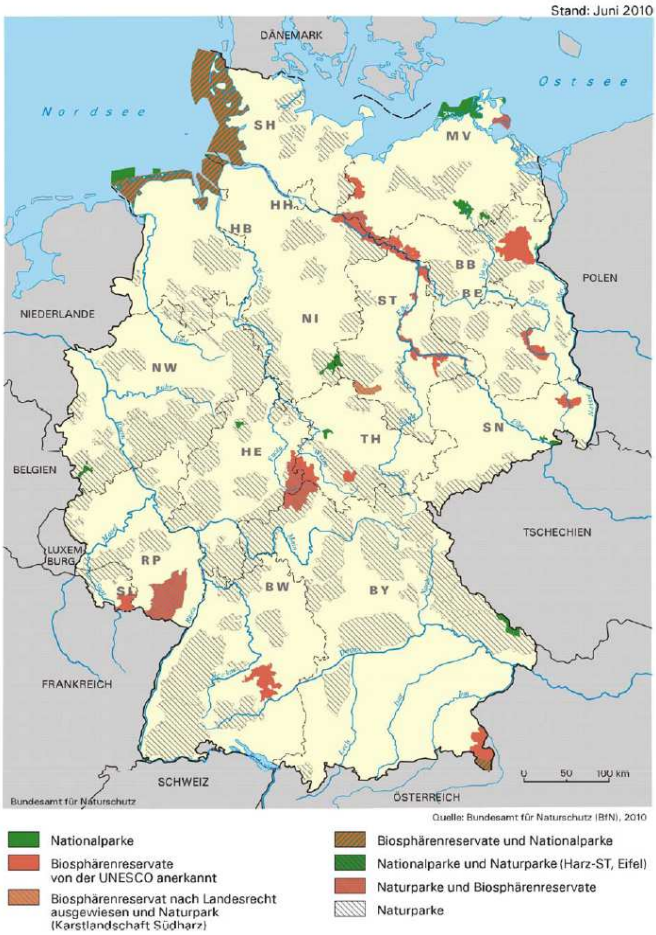


Fig. 4.1: Nature protected areas (green: national parks, red/brown: biosphere reserves, hashed black: nature parks) in Germany (BfN).

The German Federal Agency for Nature Conservation (Bundesamt für Naturschutz – BfN) is the federal government's scientific authority responsible for national and international nature conservation. The protection of the nightscape was an important aim of the agency as they published already in 2001 papers of a workshop on the influence of artificial lighting on animals in nature (Böttcher ed., 2001).

In 2013 the agency published the proceedings "Protecting the night – Schutz der Nacht" of an interdisciplinary conference in Tutzing, which show that the protection of the night is getting more and more recognized in German nature protection. The proceedings cover a large variety of themes on all aspects concerning artificial light at night and became therefore a reference publication in German language (Held et al., 2013). In the preface the president of the BfN, Prof. Dr. *Beate Jessel*, supports the necessity of protecting the night.

Fig. 4.2: Workshop proceedings from 2001 (Böttcher ed., 2001) and conference proceedings "Protecting the Night" (Held et al., 2013) edited by BfN in 2013

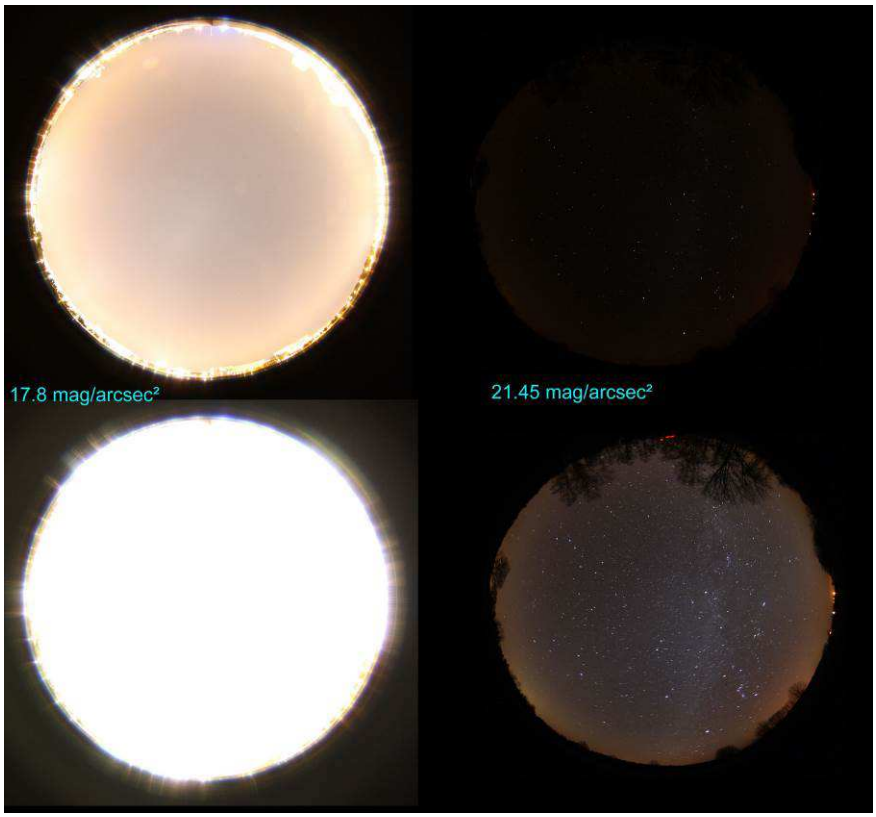


Fig. 4.3: All-sky photographs with identical camera settings and exposure times (top: 30s, bottom 180s) taken in the centre of Berlin and in the nature park Westhavelland

4.2 Some Key Data of the Nature Park

Founded:	1998 June 27th
Location:	Germany, Brandenburg, counties: Havelland, Ostpriegnitz-Ruppin
Coordinates:	latitude N 52.3° - 52.9°, longitude E 12.16° - 12.75°
Area:	1 315 km² with: forest 401 km² = 30.5 % fields 431 km² = 33.0 % greenland 368 km² = 28.0 % water 46 km² = 3.5 % communities 48 km² = 3.7 %
Nature Protected Area:	172 km² = 13 %
Landscape Protected Area:	1 018 km² = 77 %
Proposed Dark Sky Reserve:	Core zone E0: 38.6 km², inner buffer zone E1: 747.9 km²
Communities:	75.305 inhabitants in 78 communities, cities/Ämter (Rathenow, Premnitz, Rhinow, Friesack, Milower Land, Beetzsee Neustadt/Dosse and Wusterhausen)
Population Density:	60 inhabitants/km²
Board of Trustees:	nature protection groups NABU, administrations of the Land Brandenburg, the district (Landkreis Havelland), and the villages, forestry administration, water and shipping authority, farmer's cooperative, hunter's association, fishery confederation, church administration Havelland, chamber of industry and commerce, land and water community Chairman Detlef Ebert
Nature Park Administration:	Kordula Isermann (director), 5 staff members (mostly part time) administration: Pareyer Dorfstrasse 5, D-14715 Havelaue - Parey
Naturwacht:	5 members for environmental education, monitoring and control, financed by the foundation NaturSchutzFonds
Nature Park Visitor Centre:	Milow, managed by NABU

Fig. 4.4: The Milky Way over the Gülper See (lake), an important resting place for birds

4.3 Map of the Nature Park

Fig. 4.5: Map of the Nature Park Westhavelland (Naturpark Westhavelland), the situation of the nature park within Germany is shown in fig. 5.1. Four information centers are located throughout the park, the nature park administration is located in Parey. (Source: nature park brochure)

4.4 Characteristics of the Nature Park Westhavelland

The Westhavelland Nature Park is 1315 km² in size and is situated around 70 km west of Berlin. It stretches across the three counties Havelland, Potsdam-Mittelmark and Ostprignitz-Ruppin. It was established on June 27th, 1998 and is classified as IUCN Category V.

The landscape between the town of Brandenburg an der Havel, Friesack and Neustadt/Dosse is characterized by water, broad lowlands, uplands covered in woodland and small villages typical for the area with timber-framed houses and brick buildings. Around 70,000 people live in the nature park, half of whom live in the towns of Rathenow and Premnitz. Outside of these areas the nature park has a very low population density with just 30 inhabitants per km².
The sparsely populated Westhavelland with its diverse landscape is among the regions in Germany which have the greatest abundance of water. The landscape is primarily shaped by the River Havel and its tributaries. Besides some industry mainly in the cities of Rathenow and Premnitz, agriculture and tourism at a low level are the main sectors of employment in the extensive rural areas.

The lowlands of the Lower Havel are the largest continuous area of inland wetlands in western Central Europe and they are home to many threatened and endangered species of plants and animals. The Nature Park is of international importance for waders and aquatic birds. As early as 1978, large areas were declared wetlands of international importance (Ramsar area). In spring and autumn, the abundance of food and water in these areas make essential resting places for thousands of geese and swans, cranes, ducks and sandpipers on their long migratory routes. A clear starry night with the sound of thousands of birds is an extraordinary nature experience!

Many meadow breeding birds, which have now become rare in Germany, such as black-tailed godwits, redshanks, the Eurasian curlew, the common snipe and corncrakes, still have their habitats here. Beavers and the European otter also have their homes here, as do a remarkable number of amphibians, fish, insects and plants.

The Nature Park area was shaped by the Weichselian ice age around 10000 years ago. Mighty glacial masses and flowing meltwater formed the landscape. Terminal moraines, ground moraines, glacial outwash plains and broad glacial valleys were left behind. In low-lying areas, large marshlands and swamps areas were created: the Havelland Luch, the Rhinluch and the Dossebruch. Features of the Westhavelland are the terminal moraine districts and ground moraine “islands”. Like large islands they rise up out of the lowlands and act as suitable places for situating towns and villages.

The draining of the lowlands began 250 years ago and these were then used for farming. The meadows and marshes were pushed back unabated until the 1980's. However, parts of this unique lowland landscape were preserved and large areas were put under national or international protection. Around 77% (1,018 km²) of the area of the Nature Park is designated as a protected landscape and around 13% (172 km²) is protected as nature reserves. The reserves of the Lower Havel and of the neighbouring marshland areas are of outstanding importance as a part of the national nature reserve network. They are an essential link between the Elbe Valley meadows in the west and the bordering glacial valleys in the east, from Eberswalde, Berlin and Baruth, through to the lowlands of the Oder and Wahrte rivers.
Almost 30% of the nature park is covered with forest, 60% of which is dominated by extensive pine forests. In many places the way towards a stable mixed forest has been set up by bringing in deciduous trees (beech and oak).
Great bustards (*Otis tarda*) have one habitat (of just three in the whole of Germany) in the large, extensively farmed areas in the eastern part of the Nature Park. The impressive grassland birds are among the heaviest flying birds in the world. Without the intensive protection measures of the past 30 years it is certain that these birds would no longer be present here.

About 70% of the park is in private property.

Fig. 4.6: Storks nesting in the nature park

4.5 Administration

The nature park Westhavelland is one of 11 nature parks in the state of Brandenburg. The legal basis is laid down in international, federal and state law and in the statutory regulations of the large nature reserves. These are governed by the Brandenburg State Office of Environment, Health and Consumer Protection (Landesamt für Umwelt, Gesundheit und Verbraucherschutz) within the state's Ministry of Environment, Health and Consumer Protection (Ministerium für Umwelt, Gesundheit und Verbraucherschutz, MUGV). It has a managing staff of five, including a director and an administrator responsible for tourism and regional development. A team of six park rangers (Naturwacht) is responsible for monitoring animals and plants, control the protected areas, environmental education and public relations. They are financed by the foundation NaturSchutzFonds of the state Brandenburg.
A board of trustees (Kuratorium) is charged with supporting the park in its mission to stimulate the region's sustainable development by providing advice and acting as a broker of interests between the park administration, municipalities and other regional authorities and organisations. It is composed of stakeholders from various administrative levels and interest backgrounds, including representatives of several ministries, the counties and municipalities with whose jurisdiction the park overlaps, as well as delegates of regional interest groups for agriculture, commerce, tourism and environmental protection, but it has no formal decision-making power

Each municipality that is completely or partially part of the nature park enjoys a high level of decision-making autonomy within the existing regulatory frameworks. While the larger towns have full-time mayors and administrative bodies, the smaller towns are organized in townships (Ämter) that fulfill the legal and administrative duties with paid staff including a director. Nonetheless, it is the honorary elected municipal councils that take the political decisions within the settlements.

4.6 Management plan

A management plan ("Pflege- und Entwicklungsplan PEP") for the nature park is currently being developed (this is obligatory for all the protected areas in Brandenburg). This plan will contain long-term concepts for the protection, preservation and development of the nature park. Preserving dark landscapes to protect nocturnal animals and a dark sky will feature explicitly in this plan that will be finished in 2-3 years.

One basis for this will be the bachelor thesis "Der Naturpark Westhavelland als Sternenpark? - Aspekte von Ökologie, Beleuchtung und Tourismus" (Nature Park Westhavelland as Star Park? – Aspects of Ecology, Illumination and Tourism) by *Hanna Weickelt* at the University of Sustainable Development Eberswalde (supervisors Prof. Dr. *Ulrich Schulz* and Dr. *Andreas Hänel*). *Weickelt* has studied which animals live in or pass through the nature park and for which is known that they are influenced by artificial light. These are:

- Birds: migrating birds, cranes, black-tailed godwits
- Insects: 275 rare species, Makrolepidoptera
- Amphibians: night active anuran amphibians, salamanders, squamatas.

Furthermore, the management plan will include a development concept for sustainable tourism, in which the night sky and education about nature at night will play an important role.
Potentials for dark sky tourism in the region have been studied by *Sophie Kossack* in her master thesis and will be further elaborated in the framework of a study project with BA students of urban and regional planning of the Technical University of Berlin in winter 2013/14 led by *Josiane Meier*.

4.7 Weather conditions in Westhavelland

Though it may be an interesting experience to stay under a dark covered sky, the vision of a clear starry sky is certainly much more impressive. The number of clear nights is therefore essential for the attractivity of a region for astronomical observations. Nocturnal cloudiness could be derived from satellite pictures, but often only climate data will be readily available, and the data for monthly rainfall and sunshine hours can be an indicator for the number of clear nights.
The nature park Westhavelland is situated in a transition zone from maritime to continental climate. Due to the flat relief there is little orographic precipitation and a mean annual precipitation of 570 mm/year (for

Kyritz, north of the nature park, Deutscher Wetterdienst DWD, mean 1981-2010) is low, while the annual sunshine duration with 1650 hours is high. Therefore conditions for astronomical observations are relatively good for Germany. However in June and July the nights are very short and bright at the latitude of 52.25°, as the sun does not sink below a depth of -18° and astronomical twilight never ends. Especially the months of spring and autumn have relatively low precipitation and are good for astronomical observations, as can be seen in the climate diagram.

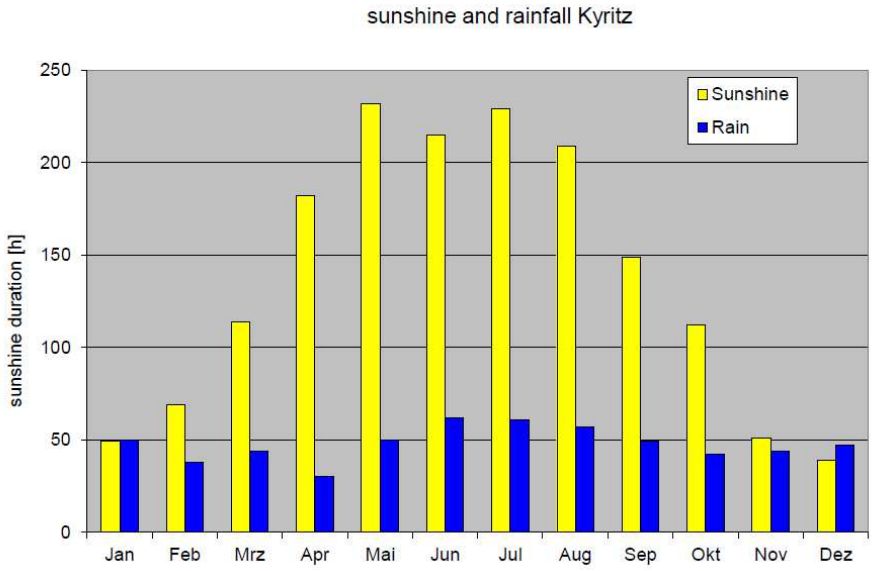


Fig. 4.7: Climate Diagram for Kyritz (N of Westhavelland), duration of sunshine [h] and rainfall [mm]

Fig. 4.8: Cranes flying over the nature park

4.8 Astronomical Tradition

Optical tradition in Rathenow

The city of Rathenow has a long tradition in optical industry. Since 1801 *Johann Heinrich August Duncker* has produced lenses for microscopes, eyeglasses and magnifying glasses. Later *Emil Busch* started producing photographic cameras and further optical firms were founded in Rathenow. By 1930 200 optical firms existed in Rathenow.
After the second World War Rathenow was the only producer of eyeglasses in the German Democratic Republic and after the reunification several important optic firms stayed in Rathenow.

Optikpark Rathenow

To commemorate the optical tradition in Rathenow, in 2007 an Optikpark (optics park) was created for the regional garden exhibition. Besides flowers several optical experiments are exhibited in the Optikpark. One specialty is the Brachymedial telescope 700/2080 mm, which is the largest telescope of this type. It has been constructed by the amateur astronomer *Edwin Rolf*, who lived in Rathenow, and was transferred to the Optikpark in 2008.

The aviator Otto Lilienthal

Otto Lilienthal is famous for his experiments to fly with hang gliders that he made at the Rhinow hills near Stölln. He studied the flight of birds and from these observations he constructed his gliders. He is certainly one of the fathers of aviation and the Wright brothers knew his work very well. Lilienthal died after he crashed during one of his flights in 1896. His pioneering work is commemorated in the Lilienthal-Centrum in Stölln, which was opened in 2011.

Fig. 4.9: The Brachymedial telescope in the Optikpark Rathenow

5 Night Sky Quality in the Nature Park

In order to know the quality of the night sky and find measures to protect it, accurate measurements of the sky quality are necessary.

The light pollution atlas of Cinzano et al. (2000) shows the northern part of the nature park as one of the darkest regions of Germany (blue, 0.11-0.33 times natural dark sky background). Amateur astronomers reported measurements of 21.7 mag/arcsec² sky brightness from some regions in the blue areas, which would correspond to almost natural sky brightness.

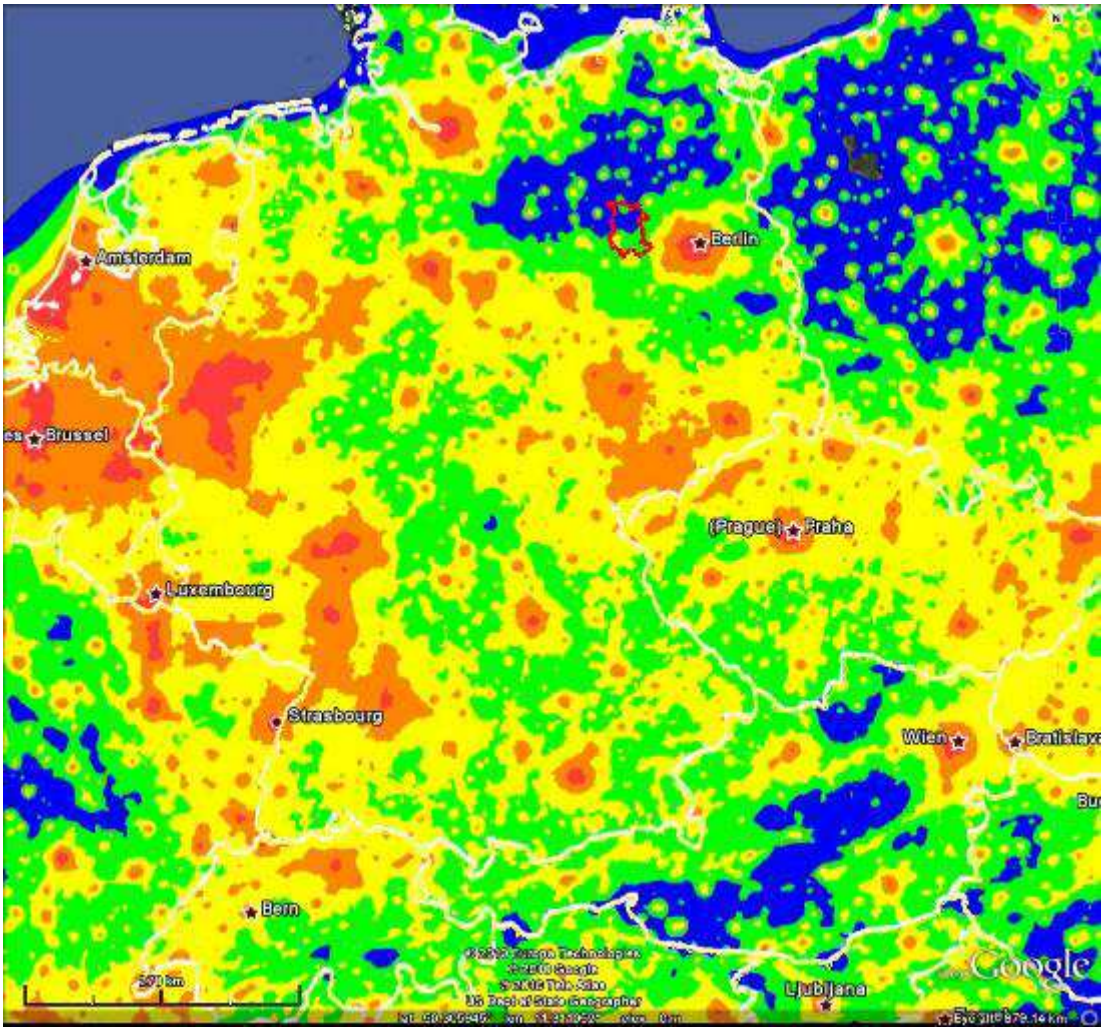


Fig. 5.1: The boundary (red) of the nature park Westhavelland overlaid on a map of the artificial sky brightness from Cinzano et al. (2000).

5.1 Single SQM measurements

First measurements were taken with a SQM-L (sky quality meter from Unihedron) in the nature park during the night April 19/20, 2009 which confirmed the dark sky with a sky brightness of over (darker than) 21.7 mag/arcsec². Measurements that were repeated in spring 2011 confirmed these values.

The measurements were always taken with precautions according to the following scheme:
First it was checked that no obstacles (e.g. trees) or bright light sources (luminaires) would influence the measurements. The first 3 measurements were ignored due to instrumental effects. Then at least 4 measurements were taken towards the zenith with a rotation between the individual measurements into the direction of the cardinal points. This method was used as we observed that changes of the values might be possible due to an optical misalignment of the SQM-L or potentially disturbing lights near the horizon. Only when we finally got consistent values these were saved and are cited in the appendix.

The SQM-L in use (serial number S/N 2536) was compared with other instruments (e.g. to photometric observations from Teide and Roque de los Muchachos observatories, Spain), with the result, that this particular instrument needs no offset correction to the readings.

We identified different factors that influence the measurements:

- The Milky Way increases the sky brightness by about 0.3-0.4 mag/arcsec² for the summer evenings and 0.2 mag/arcsec² for the winter evenings in comparison to the spring sky without the Milky Way. The exceptionally low brightness values of 21.78 mag/arcsec² could only be measured in spring.

Fig. 5.2: All-sky pictures with and without Milky Way taken in the Westhavelland, the sky brightness values as measured with the SQM-L are given

- The sky brightness decreases during the evening hours as artificial lights are switched off. This effect is smaller in dark places than close to cities, but can amount to up to 0.4 mag/arcsec² from the end of astronomical twilight until true local midnight.
- With some thin clouds, astronomical observations are still possible but they influence the sky brightness. This may have an effect of up to 0.2 mag/arcsec². This is confirmed by the measurements by Kyba et al. (2011), who found an increase of sky brightness by 0.2 mag/arcsec² in a rural place with a cloud cover of 1 Okta.
- With increased airglow activity the sky brightness can also increase by up to 0.2 mag/arcsec² as could be observed on Sept. 5/6, 2013 (see document “Observations 2013”)

As can also be recognized from the Cinzano map, the southern part of the Nature Park is relatively bright due to the proximity of the city of Brandenburg and industrial and commercial areas especially in the cities of Rathenow and Premnitz.

Potential dark places were selected using the data for 2009 and 2010 that show the annual mean amount of terrestrial upward light measured by the Defense Meteorological Satellites (DMSP). The measurements of the sky brightness were mainly taken in the part of the park north of Rathenow. Further measurements in the south were taken with the same SQM-L till 2013. The brightest value at a place without direct disturbing lightings has been measured in front of the train station Rathenow with 19.6 mag/arcsec². Using some places where measurements were taken at different times and dates as reference, we tried to correct for the above mentioned influences (Milky Way, thin clouds). Therefore two maps with the direct measurements and the corrected values have been created. The newer Visible Infrared Imaging Radiometer Suite (VIIRS) data from the Suomi National Polar Partnership satellite from 2012 have been used as background maps (fig. 5.5 and 5.6).

Detailed reports about the sky brightness measurements in the region are given in the appendix.

5.2 Roadrunner measurements

Since 2011, sky brightness has also been measured using the “Roadrunner”, a SQM-LU and a GPS on the car roof, with a program developed by *Daniel Rosa Infantes* from the Malaga Astronomical Society. Measurements of sky brightness and the position are taken at the same time and saved. It is a very efficient measuring device, as many measurements can be taken within short time, but can only be used

in regions where no trees or luminaires influence the measurements. A program for displaying the data in Google Earth was developed by *Thomas Hänel*.

Fig. 5.3: The Roadrunner system with the SQM-LU (left: mounted on the car), a GPS-USB receiver and a netbook running the roadrunner program

With this device, measurements have been taken in the southern parts of the nature park (fig. 5.5) and towards Berlin in November 2012. From the data a radial brightness profile from Berlin towards Westhavelland was derived (fig. 5.4). It shows that the zenithal sky brightness is influenced by Berlin (and Potsdam at a distance of about 23 km) out to about 40 km from the city's center. Its effect on the zenithal brightness of the nature park Westhavelland is negligible.

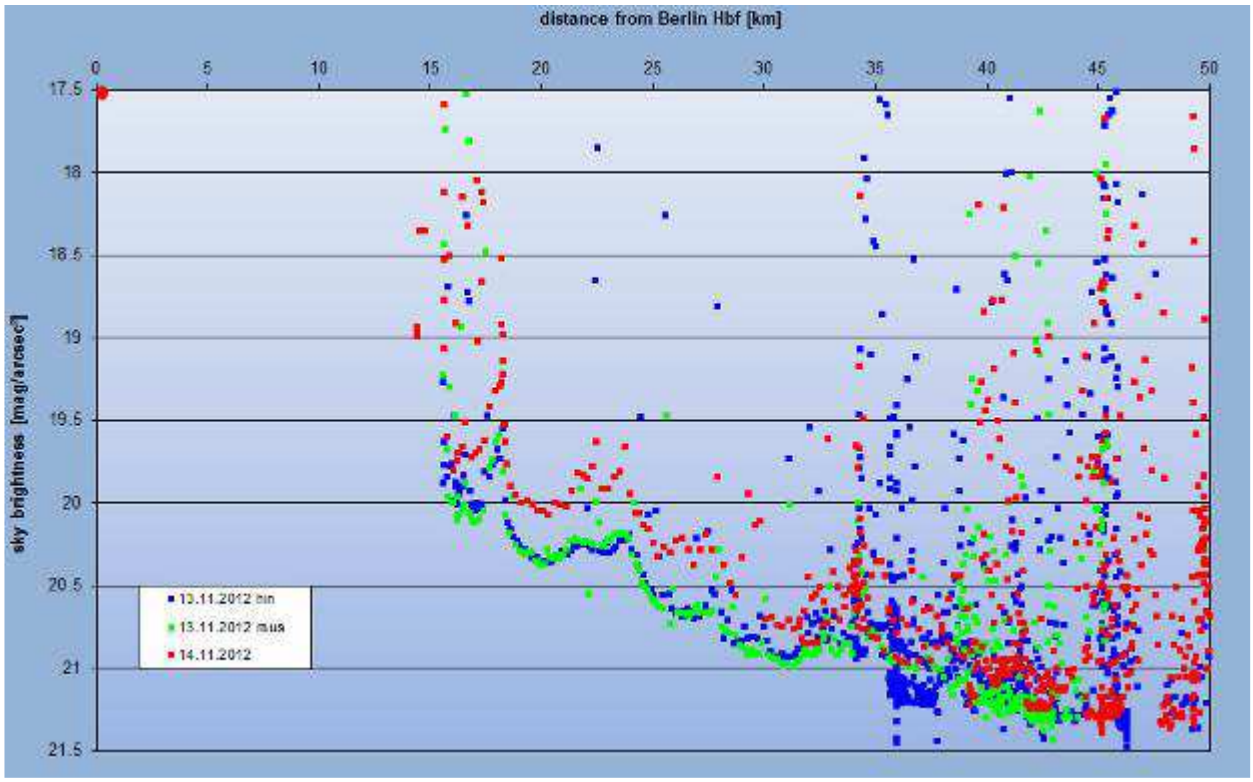


Fig. 5.4: Sky brightness measurements with the Roadrunner radially out from Berlin (13th Nov. 2012 in and out, 14th Nov. out, distance from Berlin main station). Bright peaks are due to trees and bridges that reflect the light of the headlights. Therefore only the baseline values describe the sky brightness. Between the data taken on 13th Nov (green and blue) and on 14th (red), a difference of about 0.3 mag/arcsec² is due to different atmospheric conditions and a general reduction of lights, as on 13th the data were taken late in the night and on 14th earlier in the evening.

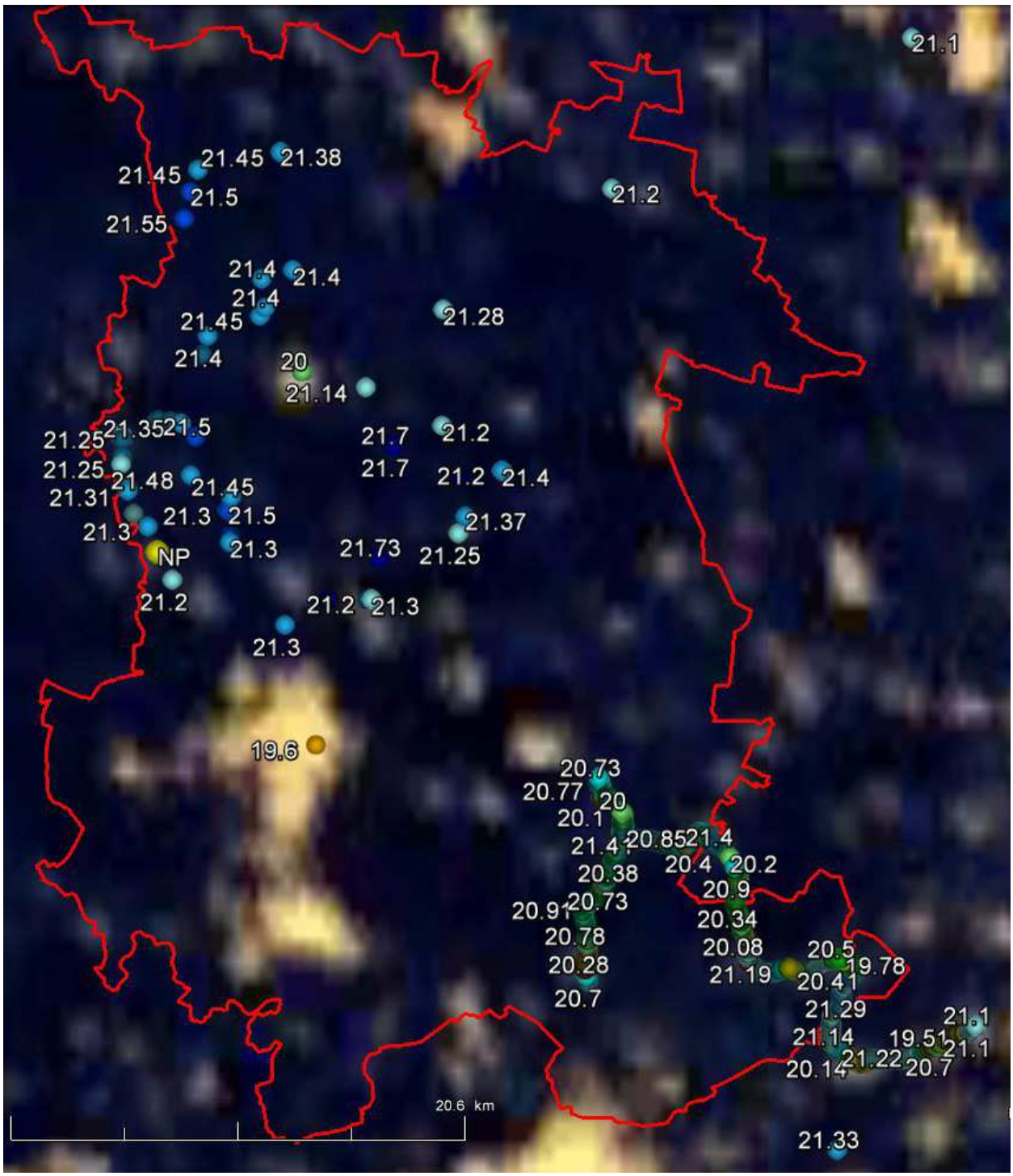


Fig. 5.5: Raw sky brightness measurements in the Nature Park Westhavelland, overlaid on the VIIRS data from 2012. Park boundary is in red, the measurements are color coded, with dark blue darkest and bright blue to yellow are brighter skies. The yellow point marked NP is the nature park administration where a SQM-LE for continuous measurements is installed. The many measurements in the southeast were taken with the Roadrunner.

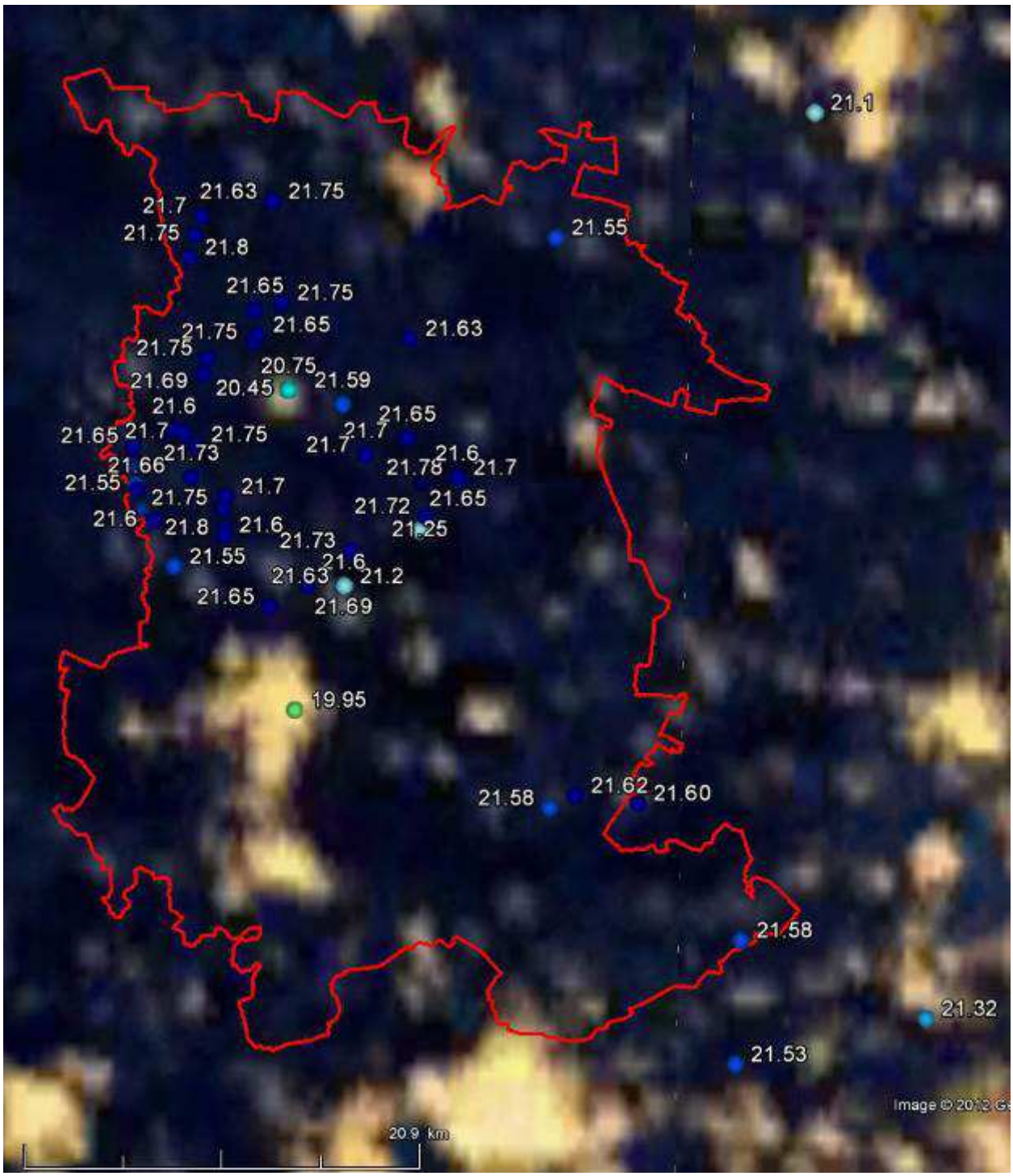


Fig. 5.6: Corrected sky brightness in the Nature Park Westhavelland, overlaid on the VIIRS data from 2012. The measured brightness values have been corrected for the influence of the Milky Way and thin cloud coverage. The park boundary is red, the measurements are color coded: dark blue are the darkest and bright blue to yellow are brighter skies.

5.3 All-sky photos

In addition to the measurements, all-sky photos with a digital single lens reflex camera (DSLR) with identical standard exposure data were taken (Canon 1000D, 800 ASA, RAW images, 3 minutes exposure time, Sigma 4.5 mm f/2.8 fisheye) on different nights and at different locations. They provide helpful information about the sky conditions in addition to the zenithal brightness measurements. A test showed that the simulated SQM-L measurements on the green channel (corresponding to visual brightness) of the pictures correlate very accurately with the real SQM measurements (Hänel 2012). *Zoltan Kollath* also reduced some of the all-sky pictures with his software giving the sky brightness over the whole picture.

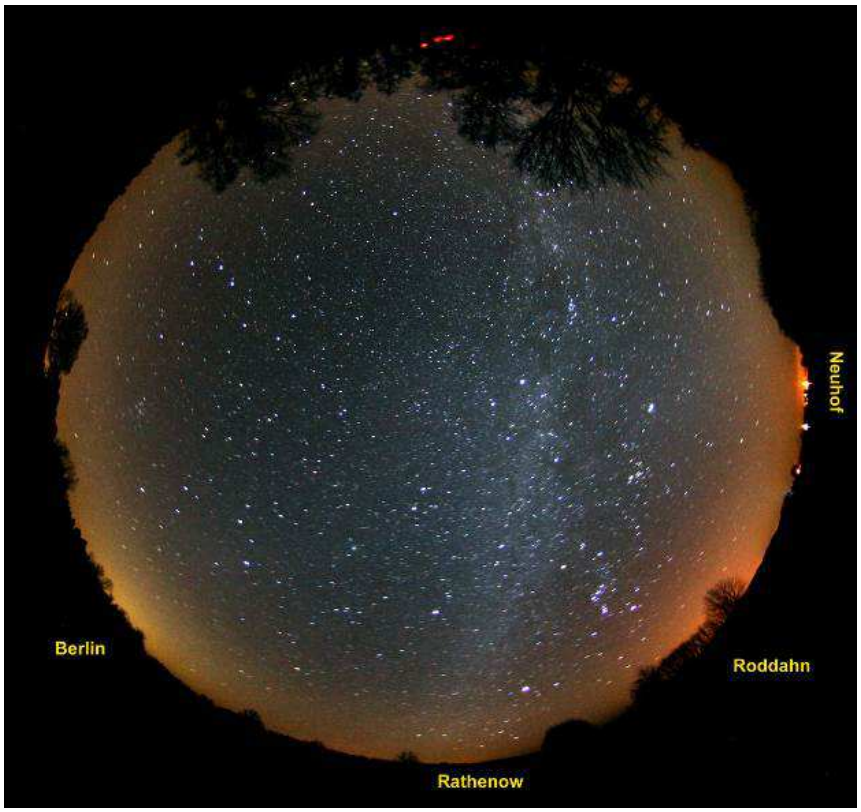


Fig. 5.7: All-sky picture taken in the north of the Nature Park Westhavelland, exposure time 3 min, 1:2,8, f=4.5 mm, ISO 800, Canon 1000D. The zodiacal band can be followed over the Milky Way, the Gegenschein is visible around the star Regulus in the constellation Leo (date 22nd February 2011).

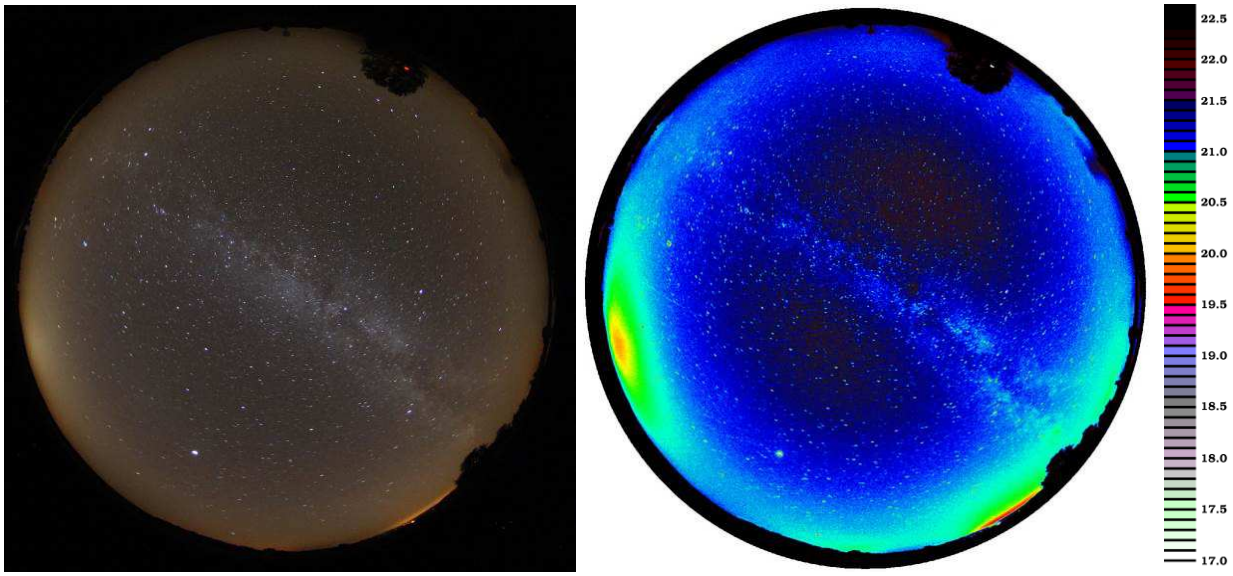


Fig. 5.8: All-sky picture from Westhavelland with a calibration done by *Zoltan Kollath* to sky brightness magnitudes (in mag/arcsec²). The light dome of Berlin in the east (left side) is clearly visible.

As documented with the all-sky photos, light domes from Berlin, which is about 70 km away, and Rathenow extend (largely depending on weather conditions) up to a height of 20° and are the main disturbing artificial light sources. But generally **scattered light close to the horizon does not rise higher than 10°**. Farther towards the north and northwest of the nature park, the light domes of Berlin and Rathenow become less prominent (fig. 5.9).

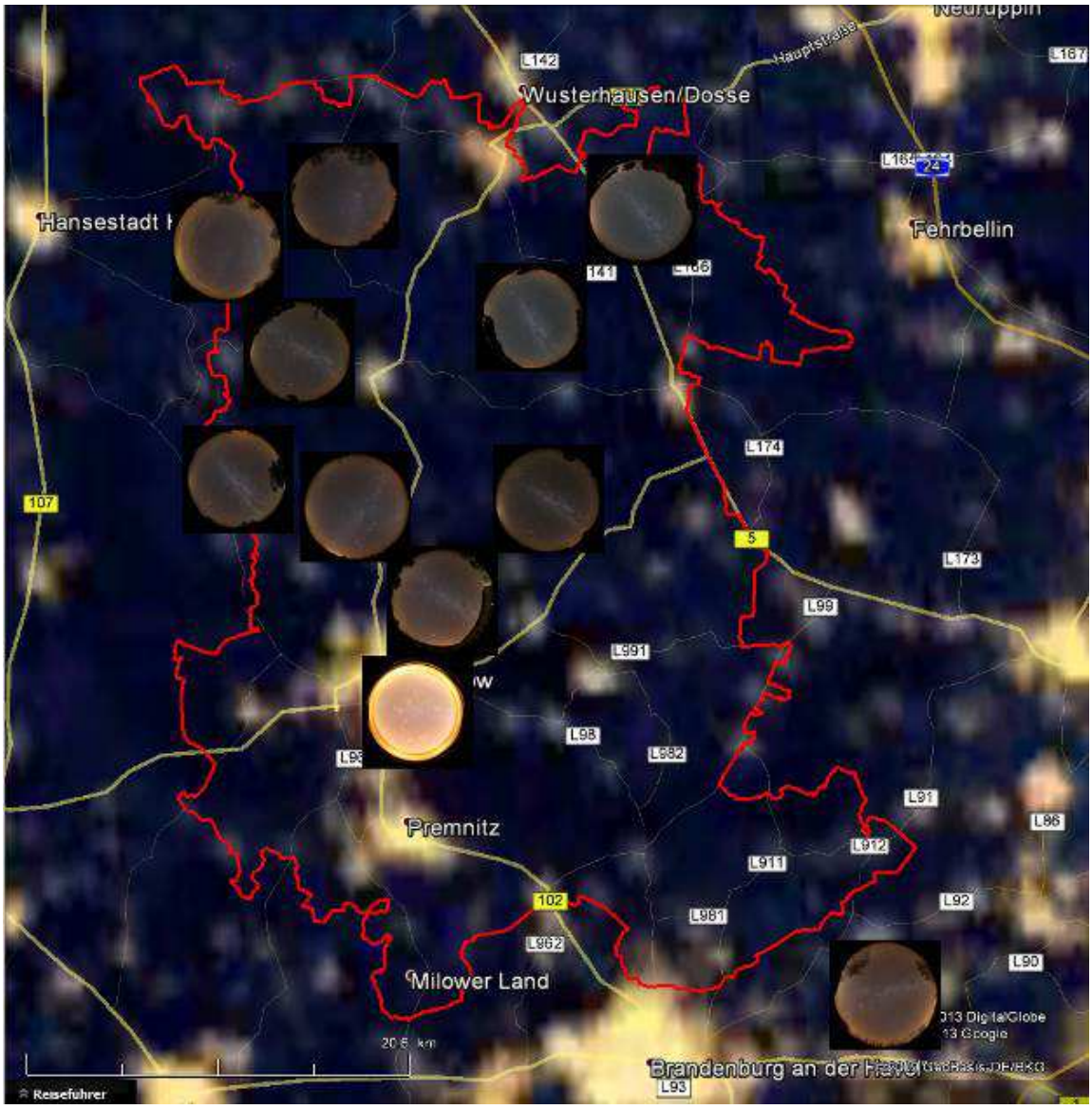


Fig. 5.9: All-sky pictures overlaid on the VIIRS map. The pictures have been taken during very different weather conditions and therefore look different.

The zodiacal light is well visible with the naked eye in spring at the evening sky, the Gegenschein during exceptionally clear spring nights (when it is located well outside of the Milky Way). It can be often detected photographically (fig. 5.7).

In September 2013 also the airglow could be seen as very faint colorless cirrus clouds, however, its characteristic green color could be detected only photographically (fig. 5.10) (Document “Observations in 2013”).

Messier objects like M5 (globular cluster), M15 (globular cluster) and M33 (galaxy) are easily visible during dark summer nights (e.g. at the star parties), indicating a sky quality class 3 on the *Bortle* scale. The limiting magnitude was determined during the summer star parties as 6.7 mag using the polar sequence of star magnitudes in the constellation of Ursa Minor.

These observations partially would support at least silver tier for the Westhavelland.

Fig. 5.10: Faint traces of the green airglow can be seen above the horizon.

5.4 Continuous SQM measurements at the park administration

In May 2012, a SQM-LE (from *Chris Kyba*, FU Berlin) was installed on the roof of the nature park administration in the village of Parey (N52.67830°, E12.24683°). This is not the darkest place in the park because it is influenced by the nearby street lighting of the village, which however is full cut-off sodium high pressure light. Therefore, the observed brightness values do not much differ from those observed at darker places within the park.
The data during the first year between May 2012 and June 2013 confirm the influences mentioned in 5.1..

Fig. 5.11: Left: *Kordula Isermann* (Nature Park director, right) and *Claudia Hesse* (Dark Sky coordinator) demonstrate the use of the SQM-LE.
Right: A SQM-LE was installed in May 2012 on one of the unused chimneys of the park administration.

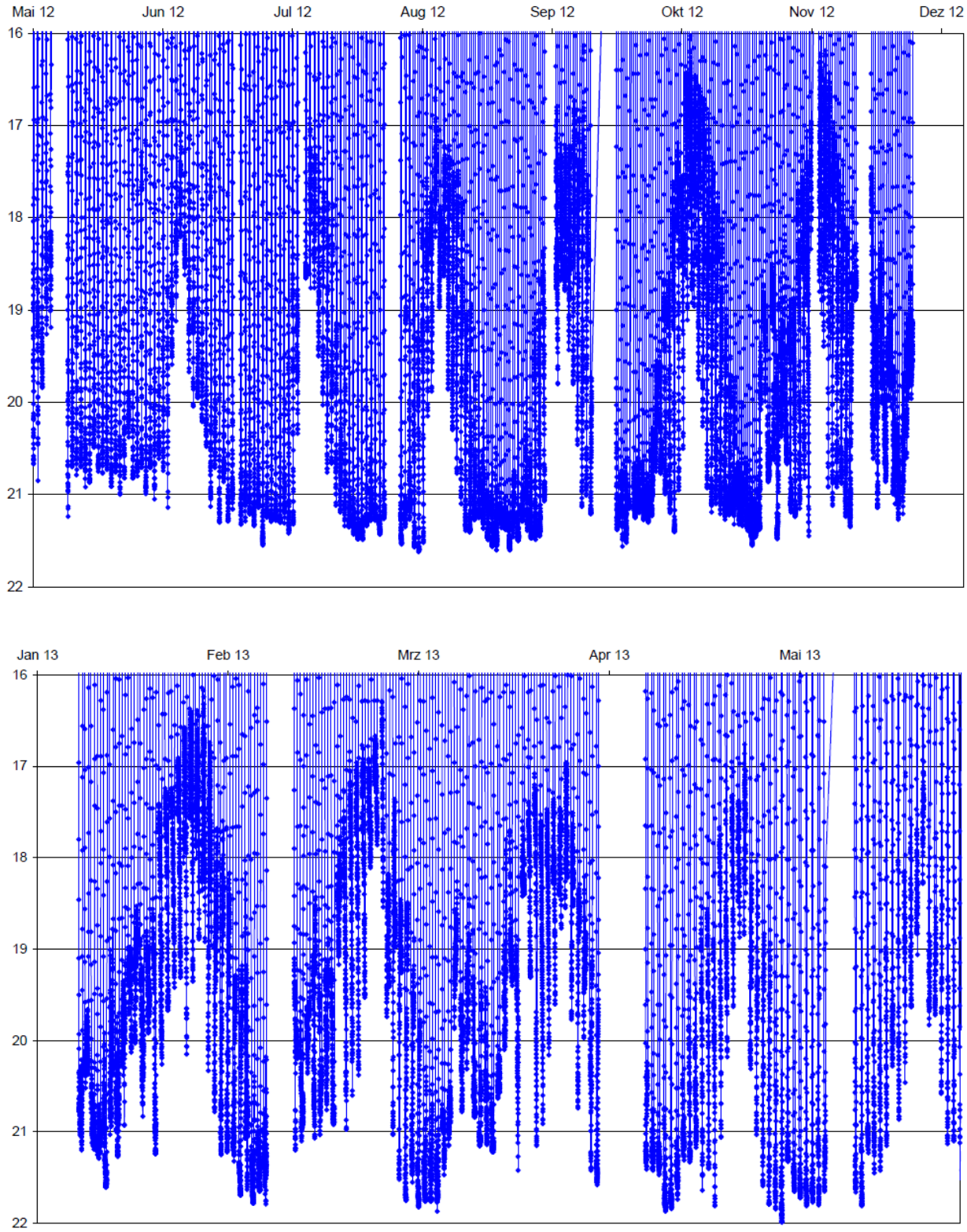


Fig. 5.12: Continuous sky brightness measurements from May 2012 to June 2013 at Parey, Westhavelland. Occasional data leaks are due to computer problems. The monthly changes due to the changing moon phases can be very well recognized. The nights in autumn are brighter than in spring due to the influence of the Milky Way, and between mid-May and mid-July the nights are brighter as the astronomical twilight never ends because the sun sinks not lower than -18° below the horizon.

Of course, these measurements will be continued to detect changes of the sky brightness.
However from the results given before, it will be difficult to distinguish long term changes, especially a reduction of the sky brightness by 15% (0.15 mag/arcsec²), from short term variations, mainly due to the influence of the weather.

5.5. General conclusions

As can be seen from these data, the DMSP and the VIIRS maps represent the sky brightness on a small-scale structure much better than the sky brightness map by Cinzano et al. (2000), proving their usefulness for identifying areas with natural darkness.

Outside the larger towns (Rathenow, Rhinow, Friesack, Neustadt/Dosse), the zenithal sky brightness is 21.6 - 21.78 mag/arcsec² in dark clear nights without Milky Way in the northern parts of the nature park. It is therefore close to natural dark sky brightness. This is confirmed by the observation of the zodiacal light in spring (especially February) and even the much fainter Gegenschein.

This could be compared to observations at other dark places with the same SQM-L, so instrumental changes should be negligible. If available, measurements for spring (without) and autumn (with Milky Way) are given. Though the measurements were taken in clear moonless nights, meteorological influences make it difficult to define a characteristic value for one place.

Country	Place	Latitude	Longitude	Altitude	SB spring	SB autumn	SB best
Germany	Westhavelland	12.477	52.712	30	21.78	21.45	21.78
	Rhön	9.985	50.460	840	21.78	21.30	21.78
	Harz	10.677	51.738	540	21.73	21.20	21.73
	Herzberg	13.272	51.708	85		21.35	21.78
	Altmark	11.459	52.896	20		21.30	
	Eifel	6.358	50.505	680		21.05	21.60
	Swabian Alb	9.334	48.222	800	21.75	21.17	21.75
UK	Exmoor*	-3.256	51.078	200		21.00	21.80
France	Quercy	1.685	44.708	380		21.65	
CZ/PL	Jizera	15.340	50.824	900		21.20	21.65
Spain	Montsec	0.743	42.048	1500		21.65	22.10
	Tenerife	-16.611	28.258	2300	21.45		21.40
	La Palma	-17.867	28.761	2250		21.60	21.90
Hungary	Zselic	17.686	46.255	170		21.40	21.60
Croatia	Lastovo	16.856	42.743	350		21.60	22.00

Tab. 5.1: Sky brightness measured with the same SQM-L at different dark places in Europe (* east of the park). Besides the coordinates of the observing places, the altitude (in m) and the measured sky brightness (mag/arcsec²) in spring (SB spring) and in summer/autumn/winter (SB autumn) are given. The darkest measured sky brightness (SB best) was taken from different publications.

From these measurements at least three areas with exceptionally dark skies can be identified (green boundaries, fig. 5.13):

1. Area Gülpe-Spaatz-Hohennauen-Parey (nature protected area Untere Havel Nord), 21 km² (lower left
2. Area Schönholz-Dickte-Görne-Witzke, 55 km² (lower right)
3. Area Kietz-Roddahn-Joachimshof-Strodehne, ca. 34 km² (upper)

Area 1 is the most characteristic and the most protected part of the nature park, the Untere Havel. It is a breeding and resting place for many endangered birds and other animals.

The main aim of the nature park Westhavelland will be to combine these three areas to one core area of the dark sky reserve once the lighting in the small villages have full cut-off fixtures that fulfill the lighting criteria for this zone.

The selection of the dark sky areas for the actual application will be described in chapter 7.

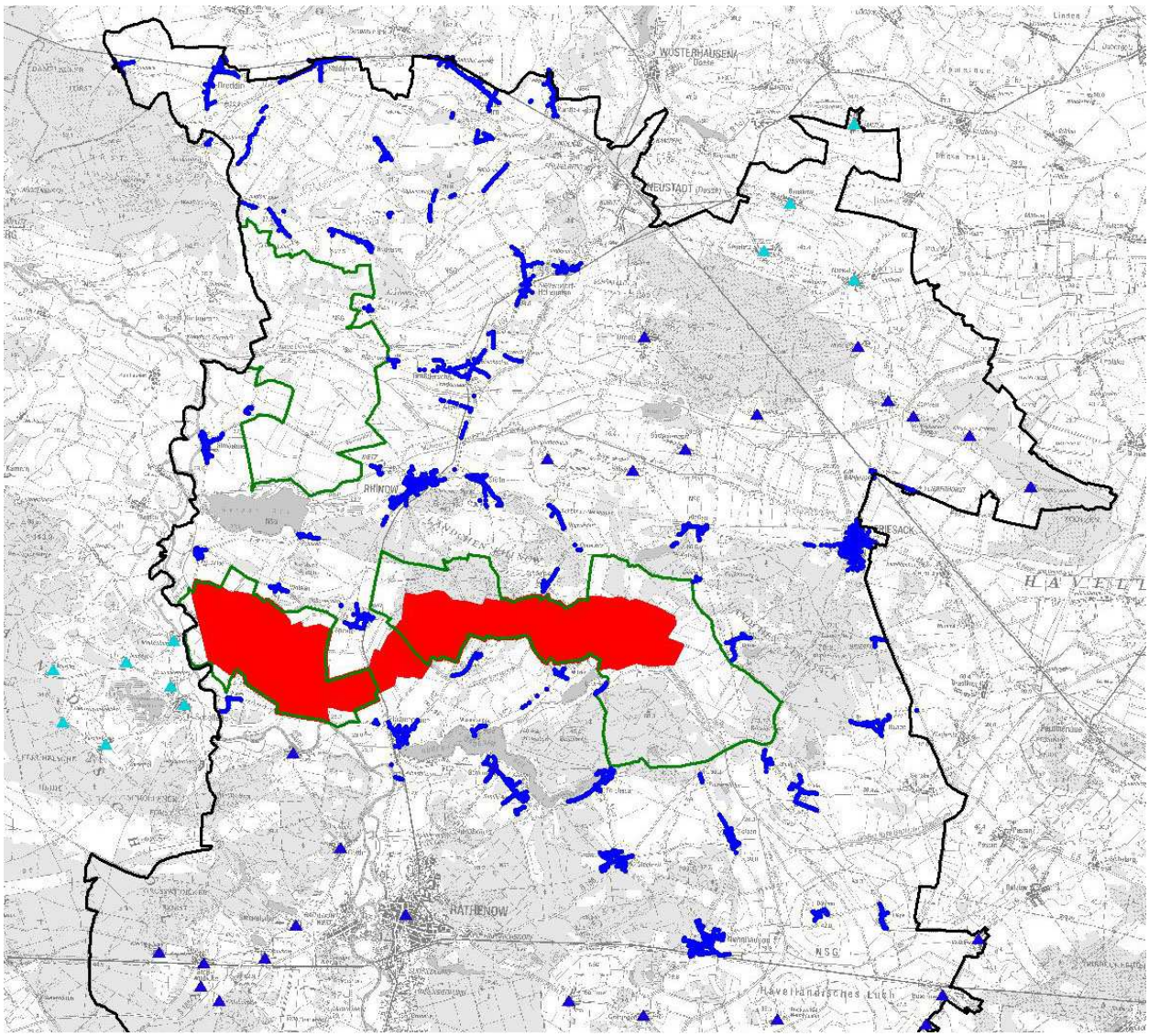


Fig. 5.13: Dark regions (green borders) without lighting and villages where lighting inventories were made. Red is the proposed core zone. Geo base data: LGB, GeoBasis-DE/LGB, 2011, LVE02/09.

6 Lighting inventory

A lighting inventory in the buffer zones helps to estimate, how much light is emitted upwards and permits to decide, where changes of the lighting will help to reduce the impact of artificial lighting into the nature protected areas.

In the southern part of the nature park (mainly in the towns of Rathenow and Premnitz) large industrial complexes were installed during the time of the German Democratic Republic, but collapsed after the reunification of Germany 1989. During the last years new industry was installed here; however, it is not very brightly lit. The night brightness in the southern region is nonetheless higher than in the north, as large cities like Brandenburg and Potsdam are close by. For this reason it will be difficult to reduce artificial light in the southern parts of the nature park. Therefore the lighting inventory excluded the township (Amt) Beetzsee for the application.

The intensity of artificial lighting is relatively low, as can be seen in the following pictures of the industrial area of Premnitz:

Fig. 6.1: Artificial lighting in the industrial area of Premnitz is low as can be seen in these pictures, which were taken with standard exposure times (1:1.4, ISO 800, 1/20 s) like for all other street scenes. This is adapted to typical road luminance of typically about 1 cd/m².

<u>Within the core</u> of the proposed dark sky reserve there is no public or private artificial light. Some old luminaires are still installed but no longer in use and no new lights will be installed. Any construction (and installation of artificial light) is controlled by the lower nature protection agency (Untere Naturschutzbehörde) of the county (Landkreis) Havelland.

Fig. 6.2: These luminaires on a pumping station are no longer in use.

The main source of artificial lighting in the northern part of the nature park is public street lighting. This is installed within the settlements which lie outside the nature and landscape protected areas. To estimate the amount of this artificial light and to identify the main contributors, a detailed inventory of the public lighting (3800 luminaires) has been made by *Hanna Weickelt* and *Florian Czeski* for the region around the proposed core zone. It has been complemented with the data of the city of Rathenow (about further 3400 luminaires), Premnitz (2012 luminaires) and some further villages by *Claudia Hesse* and *Andreas Hänel*. Altogether some 11300 luminaires were categorized; this data is presented in the appendix.

Fig. 6.3 and 6.4: Nocturnal Skyline of Wolsier (left) and Prietzen (right) in spring without leaves (top) and in summer with leaves (bottom), showing the screening effect by vegetation.

For those fixtures, for which manufacturer's photometric data was available, the ULR was determined with the lighting software Dialux (www.dial.de). However it was difficult to classify all luminaires because it was not always possible to find out the manufacturers and/or models. In these cases the upward light ratio (ULR) was estimated from the appearance or by comparing to similar models.

The mean ULR of the small villages directly around the dark sky areas is between 4 - 22%. However, much of this upward light is shielded by houses or trees during the vegetation period, as can be seen in fig. 6.3 and 6.4.. **In the city of Rathenow 57% of the luminaires have a ULR <= 0.01, of the total inventory about 29%. The aim must be to increase this fraction!**

Mainly energy efficient sodium high pressure lamps are used and the installed power and therefore the amount of light is low (typically 70 W emitting 5600 lumens - lm). In some villages, every second luminaire is switched off later during the night or the amount of light is reduced (typically by 30% or 50%).

From the lighting inventory we estimate that the mean upward flux from the settlements in the nature park is about 5% of the total produced light. Altogether the amount of light towards the sky over these villages is so small, that the contribution to the zenithal sky brightness is increased by just 0.1-0.2 mag/arcsec² near the border of the villages.

This was confirmed by an experiment during the star party WHAT in Gülpe in August 2011. When switching off 25 of the 33 high pressure sodium lamps (with an estimated total upward light flux of about 28 000 lm), the zenithal sky brightness decreased by 0.1 mag/arcsec². Therefore at such low sky brightness it is difficult to detect changes of e.g. 15 % (0.15 mag/arcsec²), even when the artificial lighting is switched off.

Most of the small villages have installed new luminaires in the years after the reunification of Germany. Therefore, most fixtures are less than 20 years old. **As typical life spans of the luminaires are 40 – 50 years, an exchange of the only partially shielded luminaires to fully shielded ones is neither sustainable (concerning the resources used for the material) nor is it financially viable at the moment as the villages are very poor.**

Fig. 6.5: Some of the old (left) and new luminaires installed in the villages of the nature park Westhavelland

The luminaires along the road in the small village of Parey, where the Nature Park administration is located, are full cut-off.

Fig. 6.6: Luminaires in Parey in front of the Nature Park administration at night and day

Another positive example is the small village of Lochow, where all 16 luminaires are full cut-off.

Fig. 6.7: Full cut-off luminaires in Lochow, skyglow in the background is from the city of Rathenow

The most practical solution to reduce artificial light would be to simply switch the lights off during the late hours of the night, which also saves a lot of money. Due to the financial situation of the public sector, many municipalities in Germany have to do this. The village of Rhinow (1680 inhabitants, 291 luminaires with a total of 1.7 Mlm, Megalumen) began switching off at midnight in 2013. The effect is shown in pictures taken before and after switching off from a distance of 5 km (fig. 6.8). The streets are totally dark. As the population has criticized that, the administration is looking for solutions to permanently run the public lighting at a reduced level.

Fig. 6.8: The city of Rhinow as seen from a distance of 5 km before (top) and after (bottom) switching off all public lighting at midnight

The amount of **private and commercial lighting** in the northern parts of the nature park is negligible as could be seen during many drives through the park. Most are only used temporarily when needed.

One of the few examples is the illumination of the church in Rhinow, the core of which was constructed before 1300 AD. It is illuminated with a luminance of 2 cd/m² as indicated by measurements with a luminance meter taken by *Wim Schmidt* from Sotto Le Stelle, Netherlands in September 2012. This level fulfills the requirements of the lighting guidelines. Besides, the illumination is switched off at midnight.

Fig. 6.9: Church in Rhinow illuminated to an illuminance of 2 cd/m²

Problematic light sources outside the park

In the western parts of the nature park a bright white light dome could be recognized which is due to the industrial area Altmark near the city of Arneburg, about 15 km west of the western boundary of the nature park and situated at the border of the biosphere reserve Mittelelbe. Main light sources are Zellstoff Stendal, the largest manufacturer of market pulp in Central Europe with high fixtures illuminating the area, and Sofitel Delipapier with bright illumination around the buildings.
As these firms stress their environmental engagement, it will likely be possible to reduce their impact on the darkness of the nature park in the future through direct negotiations. Designation of the nature park as international dark sky reserve will hopefully help this cause considerably.

Fig. 6.10: left: The industrial complex Altmark as seen from the nature park Westhavelland, right: illumination of the wood chip storage area of the firm Zellstoff Stendal.

Fig. 6.11: The North America Nebula NGC 7000, picture taken during the star party WHAT 2013 by *Guido Wortmann*

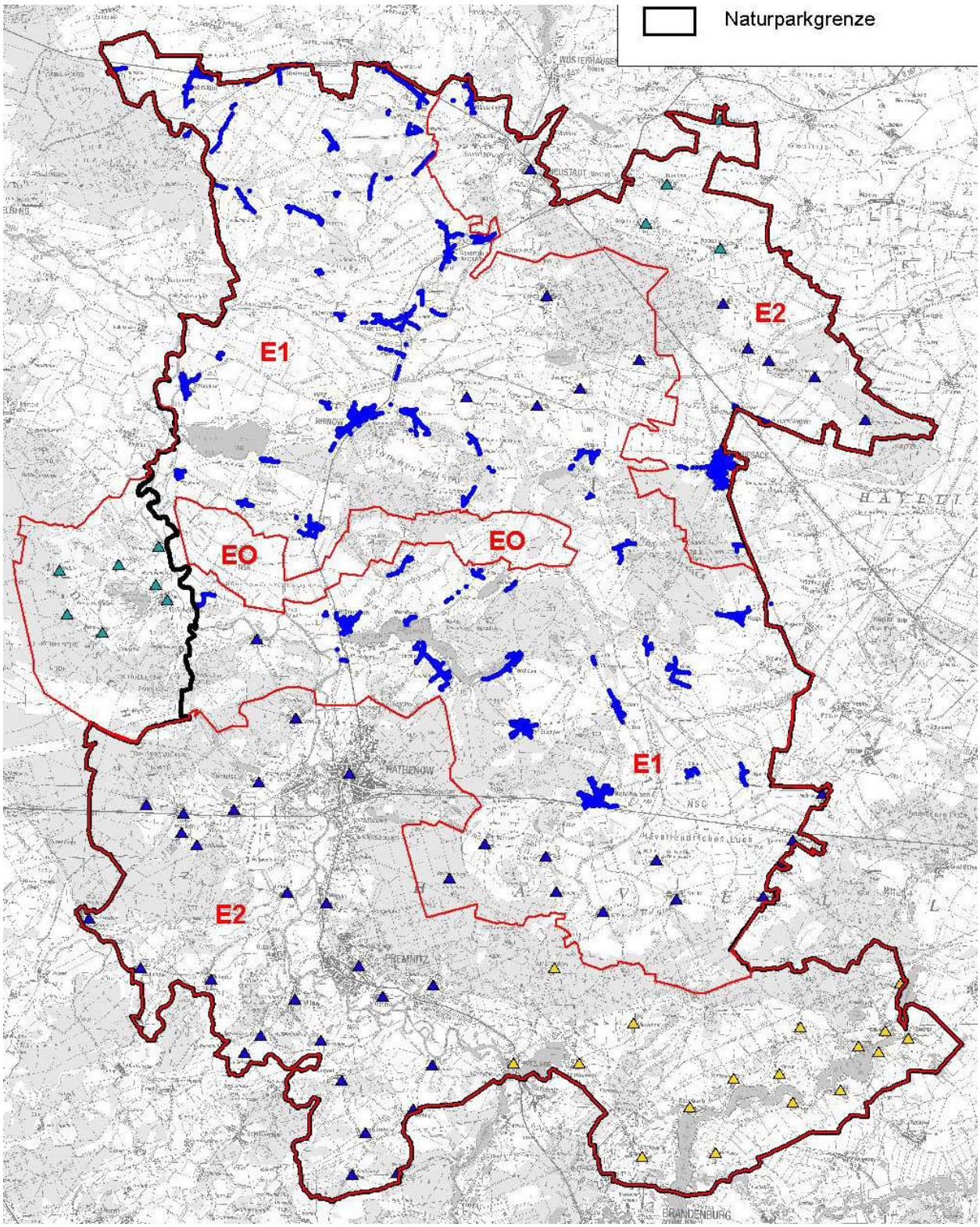


Fig. 6.12: Plan with the lighting inventory. Brown is the border of the Nature Park, red the borders of the proposed core zone E0 and the buffer zone E1. Blue dots are all individual luminaires with their positions, blue triangles where summary inventories were made and yellow triangles missing or partial inventories. The green triangles in the buffer area are inventories in the neighboring federal state (Land) Sachsen-Anhalt. Geo base data: LGB, GeoBasis-DE/LGB, 2011, LVE02/09

7 Proposed Dark Sky Reserve

Compared to other recognized IDSReserves, potential reserves in Germany have much larger population densities and therefore more municipalities with more luminaires (Hänel, 2012). German nature parks are "areas that are to be developed and managed in a consistent way…", such that environmental protection and sustainable development, e.g. through agriculture or tourism, go hand in hand.

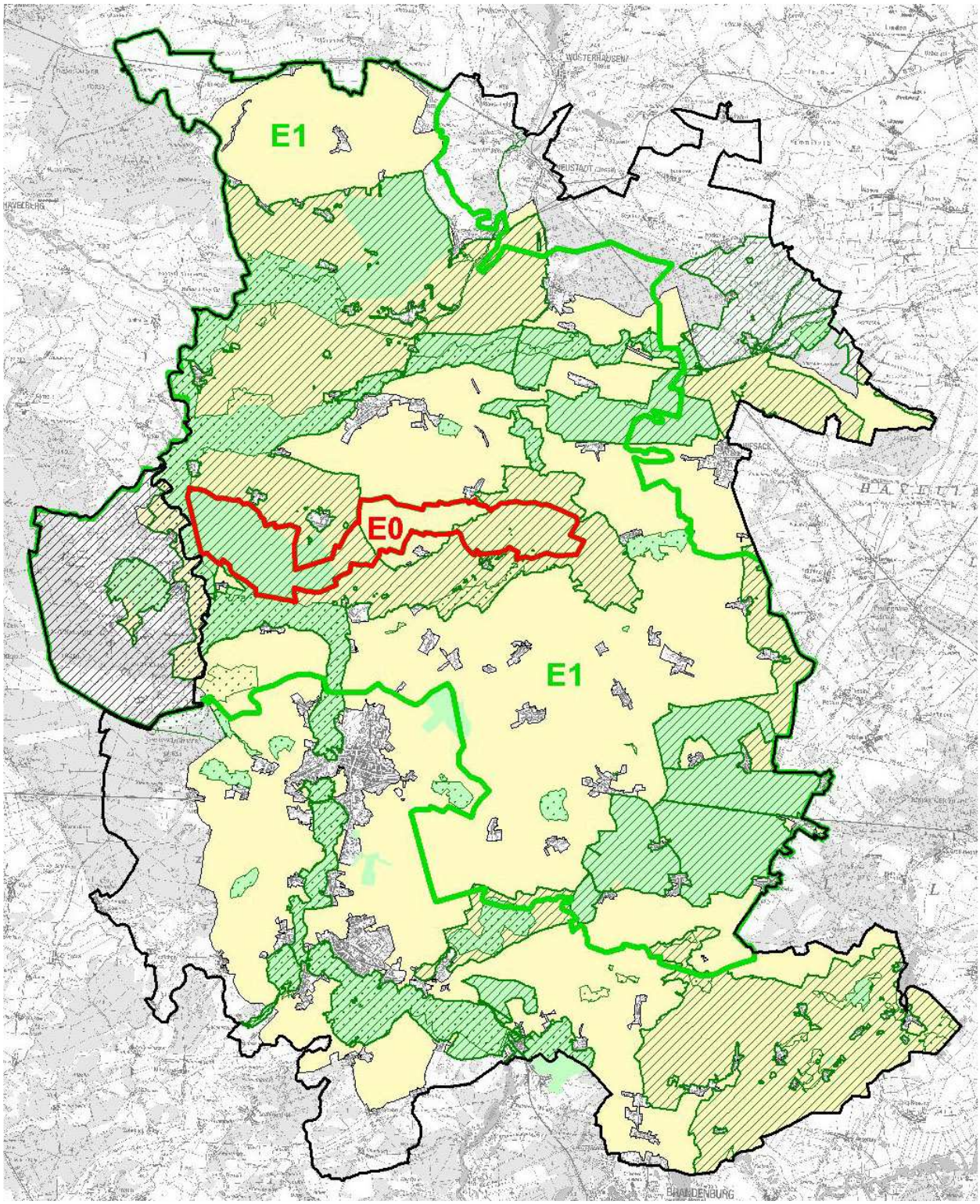


Fig. 7.1: Nature Park Westhavelland (black) with the protected areas: landscape protected areas (yellow), nature protected areas (green), FFH areas green dotted, SPA: green hashed, core zone E0 red, buffer zone E1 green. Geo base data: LGB, GeoBasis-DE/LGB, 2011, LVE02/09

The whole nature park was classified by the International Union for Conservation of Nature (IUCN) as category VI because of the high percentage of protected area and a firmly established management system.

Almost 80 % of the park corresponds to the IUCN category V - as its landscape is protected by ministerial order to protect the typical natural character of the area.
The more restrictive protection category IV covers over 40 % of the park, which are:

- 26 Fauna Flora Habitat (FFH) special areas of conservation (SAC) (Natura 2000 European habitat protection), which cover about 15 % of the nature park,
- 4 special protected areas (SPA) for birds (Natura 2000 bird sanctuaries) covering about 40 % of the park,
- 21 nature conservation areas (Naturschutzgebiet, NSG), where regional planning must give priority to nature conservation and which cover about 10 % of the park.

The different categories of protection vary in size and protective purpose. Some share mainly the same border (FFH and NSG) and some partially overlap. All specifically protected areas except the nature park itself exclude the settlements.

Protection within these areas is controlled by the Ministry of Environment, Health and Consumer Protection of Brandenburg (Ministerium für Umwelt, Gesundheit und Verbraucherschutz as “obere Naturschutzbehörde”) and the local nature protection authorities (“untere Naturschutzbehörde”) within the counties (mainly Landkreis Havelland).
Any changes to the protected form of land utilisation or the enlargement of the settlements is restricted. It can only be permitted by the local authorities if it fits into a very tight legal framework. Therefore, there are only few buildings within these areas and they do not have any artificial lighting

The settlements, where artificial light is installed mainly as street lighting, are excluded from the protected areas, even when they are situated within these, resulting in a fragmentation of the areas. From this distribution it can be recognized that it is difficult to identify a single large protected region without artificial lighting. The most characteristic parts of the nature park are the protected areas in the northwest, these are the less populated parts of the park and are less influenced by the light domes of Rathenow (to the south), Brandenburg and Potsdam (to the southeast), and Berlin to the east.

One of the most protected area of the park is the Große Grabenniederung between the villages Gülpe-Spaatz-Hohennauen-Parey (nature conservation area Untere Havel Nord) with a surface of 47 km². This coincides partially with dark area 1 as identified in chapter 5.5. Another large protected area is the special protected area SPA “Niederung der Unteren Havel” (EU number DE3339-402, surface 28.2 km²), which contains the dark areas 1, 2 and 3 from chapter 5.5.

The aim is to protect the still dark areas and for this reason it is necessary to limit and reduce the light of the villages lying within this region. It would be desirable to declare the whole SPA area as core zone, but several villages with lighting lie dispersed within this area. As discussed in chapter 6, these small villages have only few, but mostly not fully shielded luminaires and these cannot be exchanged on a short time scale due to high costs.

Therefore the largest contiguous part of the protected areas that the sky brightness measurements revealed as the darkest in the region and that do not contain villages with artificial lighting are proposed as **core zone E0** for the Dark Sky Reserve (area 38.6 km²).

An **inner buffer zone E1** surrounding the core zone was defined where public artificial light will be regulated (area 748 km²). This zone is limited to the south by the city center of Rathenow. To the west it is extended over the state border. The small villages in the neighboring state Sachsen-Anhalt are part of the biosphere reserve Mittelelbe and have few and faint lighting. The nature park administration is working with the biosphere reserve administration to protect the night sky there through a responsible lighting – it is planned to reduce the light during the night.

The lighting in the villages surrounding the core shall be transformed into dark sky friendly lighting according to the lighting guidelines for the buffer zone E1. This change is only possible on a long timescale (10-20 years) when replacements become necessary. The local municipal councils have to decide on the public lighting in the villages, therefore they had to vote to follow the lighting guidelines.

The other regions of the nature park (including the cities of Premnitz and parts of the city of Rathenow) outside buffer zone E1 are situated within the **buffer zone E2**. The municipalities within this zone should also sign the lighting guidelines.

The core zone E0 is accessible to the public on small roads which offer various places where astronomical observations, as well as nature observations during the day are possible. These places are listed in an information leaflet (also available on the internet), that people interested in astronomy can choose their observing places there. Parts of these roads might be closed due to flooding mainly in winter/spring or breeding of protected birds mainly in spring, but most others are accessible.

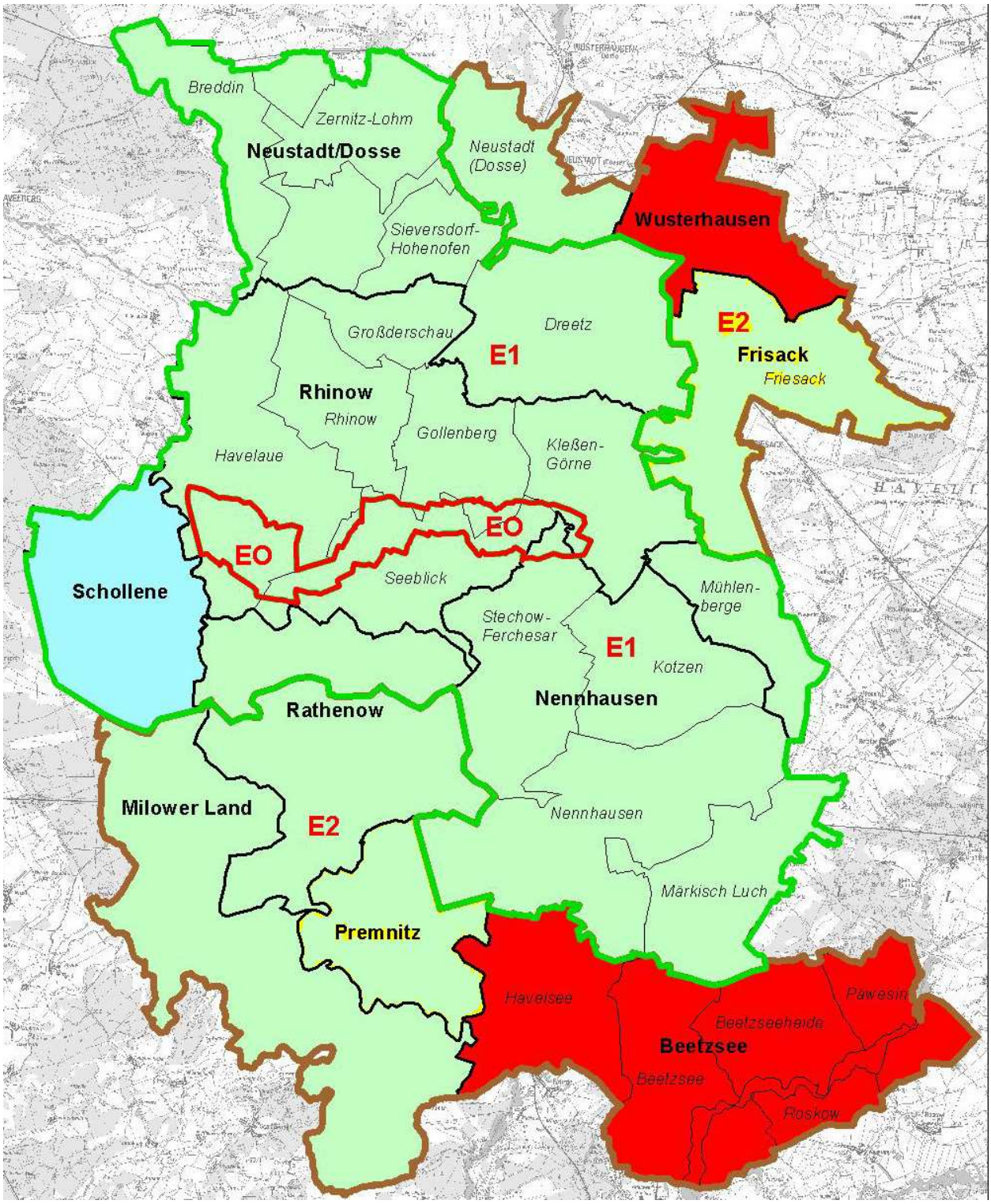


Fig. 7.2: The proposed zoning (core E0: red border, inner buffer E1: green border, nature park and E2: brown) of the dark sky reserve in the nature park Westhavelland and the state of the formal recognition of the lighting guidelines: green: guidelines have been accepted by voting or by acceptance by the mayors, yellow: support for the dark sky reserve, but formal acceptance in progress, blue: same but for Schollene in Sachsen-Anhalt (not belonging to the nature park), red (Beetzsee and Wusterhausen): the lighting guidelines have not yet been presented for voting.
Geo base data: LGB, GeoBasis-DE/LGB, 2011, LVE02/09

Fig. 7.3: Places for astronomical observations between the villages of Parey and Gülpe in the proposed dark sky park.

Fig. 7.4: All-sky photo at one of these places in autumn

„Dark Sky Reserve“ is difficult to translate and the word “Dark Germany” is a negative and even discriminating term for regions of the former German Democratic Republic. Therefore we prefer the term star park = “**Sternenpark**” for the proposed dark sky reserve.

8 Lighting Management

8.1 Lighting guidelines for the public lighting

Lighting guidelines have been worked out by the working group Dark Sky of the German amateur astronomers' association (Vereinigung der Sternfreunde) together with the administrations of the nature park Westhavelland and the biosphere reserve Rhön. They are based on the guidelines for International Dark Sky Reserves of the IDA (vers. 1.2, March 2008), the guidelines for Dark Sky Preserves of the RASC, the Starlight reserve recommendations and recent scientific results and publications.
They have been discussed with regional lighting experts and were presented to and discussed with mayors and the construction departments in several presentations (Rathenow 2012 Sept. 21, Nennhausen 2012 Oct. 25). They were also discussed with *Rene van Ratingen*, a well known lighting engineer working at a large lighting firm.

These guidelines contain the following documents:

- Pre-formulated decisions for the municipal councils
- Explanations accompanying these decisions on how to reduce light pollution
- List of examples of full cut-off luminaires available on the German market

Many discussions with people who are responsible for lighting (municipalities, energy suppliers, local electricians) showed that guidelines for lighting must be as concise as possible.

Within the nature park Westhavelland, the following lighting guidelines will be applied (details in the appendix):

Core Zone E0

No artificial (public and private) lighting will be installed in the core of the dark sky reserve.
The proposed core zone with an area of 38.6 km² is partially nature protected land (Naturschutzgebiet NSG), partially Special Protected Area (Natura 2000) and totally landscape protected area. Construction (including installation of artificial lighting) or settlement within this region is generally not permitted. The protection of this area is controlled by the local environmental and building department (Landkreis Havelland) and the nature park administration must be consulted in any case.
If artificial lighting should be necessary (e.g. for security reasons), it must:

- use full cut-off fixtures if lamps are brighter than 1000 lumens
- use preferably yellow or warm white colour (correlated colour temperature 3000 K or less)
- be switched-on only when necessary.

Even the permission for the temporary scientific experiments of the research group "Verlust der Nacht" with street lighting just outside a NSG was a long process with strict constraints to protect the environment. The core area belongs to the townships of Amt Rhinow and Amt Nennhausen.

Buffer Zone E1

The darkness in the core zone will be protected through buffer zone E1 surrounding the core with an area of 747.9 km². The development outside of the settlements is controlled by the local environmental and building department (Landkreis Havelland), like in the core zone. The councils of the cities and townships (Amt) are responsible for the **public artificial lighting** on their areas. In the villages of the buffer zone luminaires must be installed according to the lighting guidelines, when new luminaires are installed or old fixtures need to be replaced. The local governing bodies of <u>all</u> municipalities of zone E1 lying within the nature park have taken formal decisions to support the star park and to follow the lighting guidelines:

- Amt Rhinow: Rhinow, Seeblick, Kleßen-Görne, Havelaue, Großderschau, Gollenberg
- Amt Nennhausen: Nennhausen, Kotzen, Stechow-Ferchesar, Märkisch-Luch
- Neustadt (Dosse), Kreis Ostprignitz-Ruppin
- Rathenow (partly)

The municipality Schollene, which lies outside of the nature park in the neighbouring state Sachsen-Anhalt, supports the aims of the star park but is in the process to take a formal decision.

Amt Rhinow is the most important of these townships, as the core zone and most villages in the buffer zone are within the boundary of this township: The elected representatives are very supportive of the aim of protecting the night in the nature park and passed the decision mostly unanimously. The township supports all the activities of the sky park as far as they can finance it. And the director of the administration, *Jens Aasmann*, assists at all events around the star park.

The lighting guidelines (see appendix) specify simple but effective rules for dark sky compliant lighting:

- In future only full cut-off (ULR=0% or – even more sharply - lighting class G6) luminaires shall be installed.
- Lamps with high efficiency and color temperatures below 3000 K shall be used as ecological light sources with low content of blue light.
- Illuminances must not be brighter than 2 cd/m², self-illuminating signs not brighter than 50 cd/m².
- Maximum illumination level for streets shall not be higher than 10% over the levels recommended in norm DIN/EN 13201. This upper value was agreed on during European IDA meetings in Genk and Brussels (2005). From a juridical point of view lower values than those defined in the norms cannot be recommended though in practice levels in use are mostly much lower than specified by the norm.
- Reducing the light during the night (total or partial switch-off, illumination on demand, illumination with motion sensors) between 23:00 and 5:30 is recommended.
- Using a bright pavement (concrete) will also allow using lower illuminance values.

The villages in the nature park have already demonstrated their willingness to reduce light pollution by applying the lighting guidelines for new installations or replacements. This will be shown by the following examples which have been planned during the application process since 2011/2012.

Outer Buffer Zone E2

The rest of the nature park is within the outer buffer zone with less strict regulations than zone E1. This includes the city center of Rathenow and the industrial areas of Rathenow and Premnitz.

The lighting guidelines are less strict (compared to zone E1) in a few points:
- ULR can be up to 3% in built areas where the light is blocked by buildings (mainly city centers)
- Illuminances must not be brighter than 5 cd/m², self-illuminating illuminating signs not brighter than 100 cd/m²
- Switch-off is recommended between 24:00 and 5:00.

The following municipalities lie in the E2 zone. They have voted or an administrative decision to follow the guidelines:
- Rathenow (partly)
- Milower Land
- Premnitz
- Friesack

The following towns support the star park but have not yet finally voted on the lighting guidelines:
- Beetzsee (Beetzsee, Beetzseeheide, Päwesin, Roskow, Havelsee), Kreis Potsdam-Mittelmark

All communities within the core and buffer zone E1 have adopted the guidelines. Referring to the total nature park, communities with 75.6 % of the area of the nature park and 68.7% of the population had formally adopted the lighting guidelines till Oct. 2013. With the voting of Premnitz and Friesack in 2013 Dec. 84.1% of the area and 90.8% of the population will follow the guidelines.

8.2 Examples of compliant replacements

Example 1 Rathenow-Semlin

In Rathenow-Semlin 34 luminaires with mercury vapor lamps were replaced using full cut-off LED luminaires with 3000 K LEDs in October 2011. This reduces energy consumption from 22.000 kWh to 4.900 kWh.

Fig. 8.1a: These luminaires with Hg lamps in Semlin (left) were replaced by warm-white full cut-off LED (right) luminaires in 2011 (pictures taken with identical camera/lens and exposure settings).

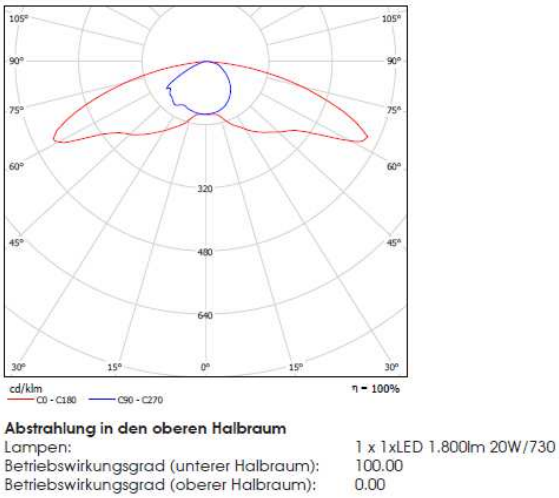


Fig. 8.1b: Light distribution (Leipziger Leuchten)

Example 2: Hohennauen

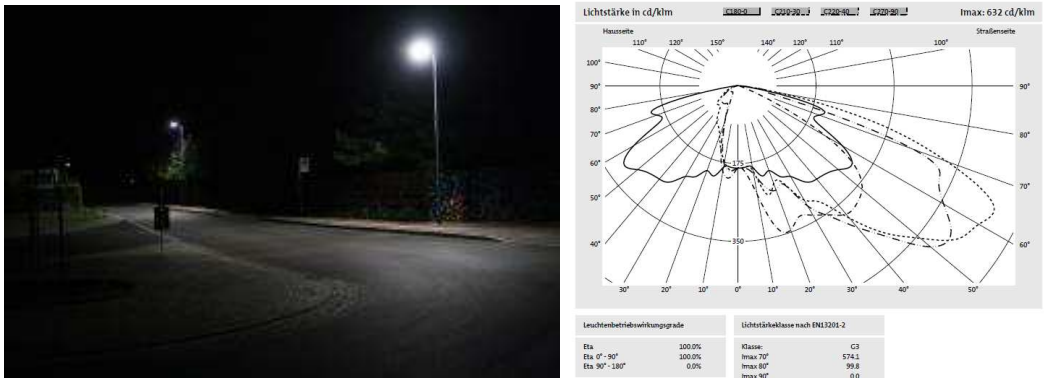


Fig. 8.2: At a bus stop at the school in Hohennauen, 3 full cut-off luminaires (Siteco Streetlight 10 mini) have been installed; the light distribution is to the right.

Example 3: Kotzen

Fig. 8.3a: Replacement of a complete street in Kotzen with 28 fully shielded Siteco SQ 100 with sodium high pressure lamps, ULR = 0.1%

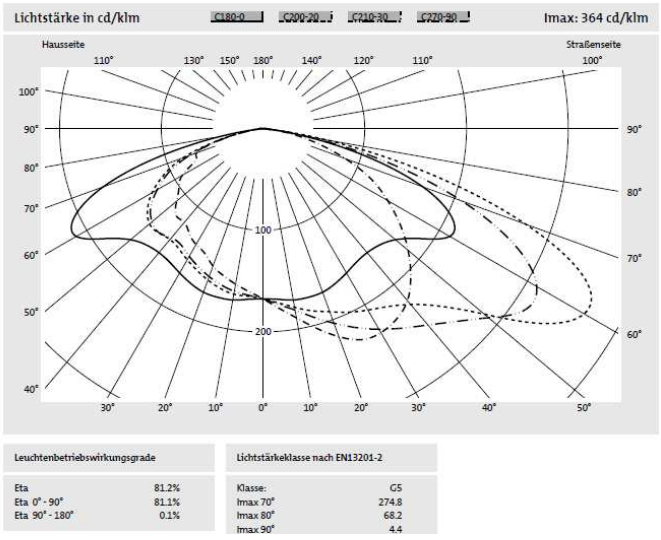


Fig. 8.3b: Light distribution of Siteco SQ 100

Example 4: Klessen

Fig. 8.4: Replacement of 5 luminaires (old was ULR ~ 20%) in Klessen with Schréder Isla (ULR = 0%), (warm) white LED

Example 5: Rathenow, Berliner Straße

In the center of Rathenow new modern lighting with about 50 full cut-off luminaires and warm white (Cosmopolis) lamps was installed, which is in accordance with the lighting guidelines. The decision for the lighting was, however, made before the city accepted the lighting guidelines and therefore some decorative unshielded lighting as well as high illumination levels (perhaps due to planning errors) were installed. A change to lower levels will only be possible at additional costs.
However, the city council has meanwhile taken the formal decision to follow the lighting guidelines in future.

Fig. 8.5: Full cut-off street lighting Berliner Straße in Rathenow

Example 6: Lighting Nature Park administration

Another example of learning is the outdoor illumination of the nature park administration building. The administration asked for only downward lighting, but LED floodlights with cold white color (6500 K) were installed in 2012. Finally these have been replaced in 2013 by 5 full cut-off luminaires with warm white LEDs and motion detectors..

Fig. 8.6: LED floodlight with cold white light (left) were replaced by full cut-off luminaires with warm white LEDs (right).

Example 7: Lighting of the Fire Brigade in Gülpe

Fig. 8.7: The houses of fire brigades have to be illuminated. But the 3 old unshielded luminaires (middle) have been replaced by cut off ones (right). These are warm white LED with a yellow filter to remove blue light. The orientation was not yet adjusted because a tv team wanted to film the adjustment.

Further replacements of old luminaires will be necessary during the next years as from 2015 the trade with mercury high pressure lamps will be forbidden in the European Union. However, the number of these lamps is already relatively low, such that an exchange of the luminaires will reduce the upward light only by a small amount. Replacement of the current luminaires to better shielded ones will only be possible on a timescale of about 20 years as discussed in chapter 6.

A total of about 2800 of the 11328 luminaires that have been counted in the nature park are switched off partially or totally during the night.

In total about 138 luminaires have been exchanged according to the guidelines at least partially during the process of the application.

8.3 Non-Public lighting

The lighting guidelines can address only public lighting. This is important as it is the main contributor to artificial light in the nature park. Within German legislation non-public lighting can only be regulated if it is of excessive disturbing brightness. Within the nature park, non-public lighting does not have much influence. A massive increase of private lighting cannot be expected as the population within the nature park Westhavelland has decreased between 1990 and 2008 by 10 - 26% (different values in different municipalities). It is expected to decrease by further 3 to 9 % from 2008 to 2020 (Landkreis Havelland, 2010).

Nevertheless, guidelines for reducing non-public lighting are also given. Future pressure may arise due to the energy concept of the German government to use regenerative energies. Therefore the installation of wind power stations which need security lights and biogas energy stations could become the cause for further artificial lighting around the nature park, which is therefore also addressed in these guidelines.

An information leaflet on artificial lighting was printed and is widely distributed. Another one will be distributed by the Landkreis Havelland to those people asking for a construction permit. It informs about using artificial outdoor lighting which will limit light pollution.

Fig. 8.8: Leaflet “Save the night” about good lighting

It is expected that with the recognition of the nature park as International Dark Sky Reserve it will be accepted as a good example for good lighting practices and that this will convince more municipalities and the general public in the near and farer surroundings to change towards environmentally friendly and sustainable forms of lighting thereby protecting dark areas and the nighttime environment.

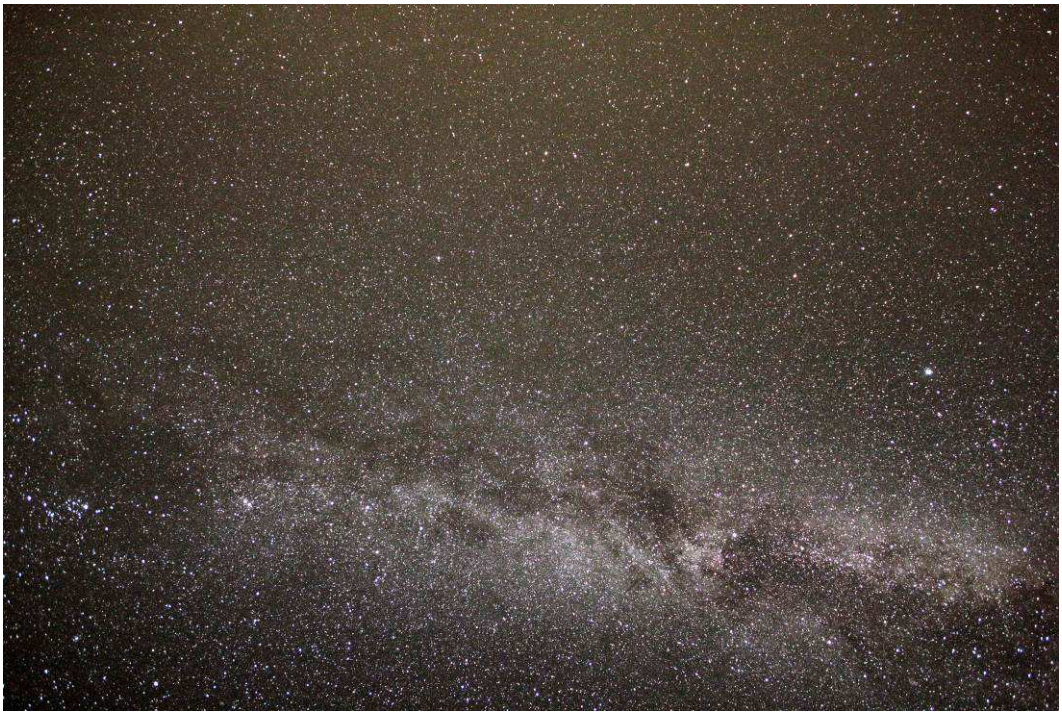


Fig. 8.9: View of the Milky Way, photo taken at the star party WHAT 2013

9 Public Outreach

Dark skies with an impressive starry sky are rare in a densely populated country like Germany. The proximity of the nature park Westhavelland to the metropolitan region Berlin/Potsdam with about 4.4 million residents is a good opportunity for many people who are used to bright city skies to experience a still natural dark environment. The interest in the whole country has been proven both through media reports and the visitors at the local star parties and shows already the potential for a touristic development of the area as a star park.

The local media (Märkische Allgemeine, Brawo) reported intensively about the political decisions in the villages of the proposed star park and communicated them to local citizens.
The dark sky of the nature park is mentioned with several pictures in the first German book about light pollution (*Thomas Posch* et al.: p. 46). It has also been mentioned in an article about the DMSP data in the German astronomy journal Sterne und Weltraum (January 2010, p. 78-83):

Fig: 9.1: Some articles about the sky quality in the Nature Park Westhavelland

Meanwhile, many further press articles, also in regard to other German dark sky projects in Rhön and Eifel, have reported about the project in the Westhavelland (see Appendix).

At the new moon weekend of August 2011 amateur astronomers were for the first time invited into the nature park to discover the quality of the dark sky: WHAT – **W**est**H**avelländer **A**stro**T**reff. They were impressed by the quality of the dark sky. Further star parties followed in September 2012 and 2013 and

were mainly organized by local non-profit associations (local fire brigade, association “Kunst und Kultur”) and the nature park administration.

Fig.9.2: left and right: The program flyer for the star party in Sept. 2012 and 2013, middle: the activities guide for 2013 for the nature park presented the night sky.

The star parties WHAT were also used to invite the local residents to inform them on astronomical themes, the quality of their night sky and the importance of protecting it. Introductions to astronomical observations and the problems of light pollution were given to local park guides and rangers.

Fig. 9.3: A 24” Dobsonian at the telescope meeting WHAT 2011

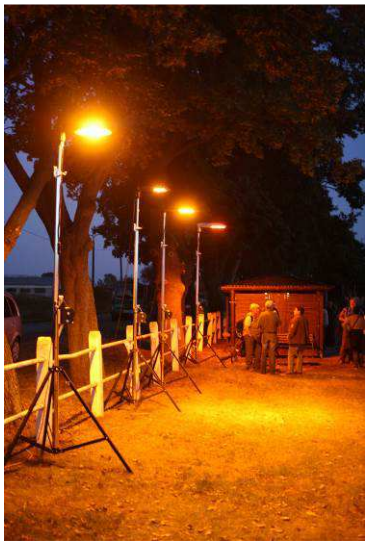
Fig. 9.4: Park guides and ranger listen to an introduction to simple astronomical observations

Fig. 9.5: During the star party WHAT 2012 talks were given by *Rolf König* from Potsdam planetarium about Galle, the discoverer of Neptune (left), and *Dr. Annette Krop-Benesch* from the research group “Verlust der Nacht” about the negative impact of artificial lighting (right), both together with *Kordula Isermann*, director of the nature park. In the background the exhibition on light pollution can be seen.

An initiative of the Federal Ministry of Education and Research
Science Year 2012
PROJECT EARTH
Our Future

In 2012 the research project “Verlust der Nacht” participated with activities around the night for children and adults and different talks. The German working group Dark Sky also provided an exhibition and information material for the public. This was part of the national science year 2012 “Project Earth – Our future”.

Fig. 9.6: Observing the stars at the star parties WHAT 2012 and 2013



The star party in September 2013 had an especially high press resonance as the German press agency *dpa* reported about it. Several radio and tv teams participated in the meeting and 45 articles were published nationwide. *Deutsche Welle*, Germany's international broadcaster, reported also internationally about the dark sky in Westhavelland and the struggle for becoming a dark sky reserve.

During this star party, *Harald Bardenhagen* also demonstrated some street luminaires with amber LEDs as good examples for an environmental lighting. Local administrations and politicians were very interested in seeing these.

Fig. 9.7: Luminaires with amber LEDs as demonstrated during the star party in 2013 by *Harald Bardenhagen*.

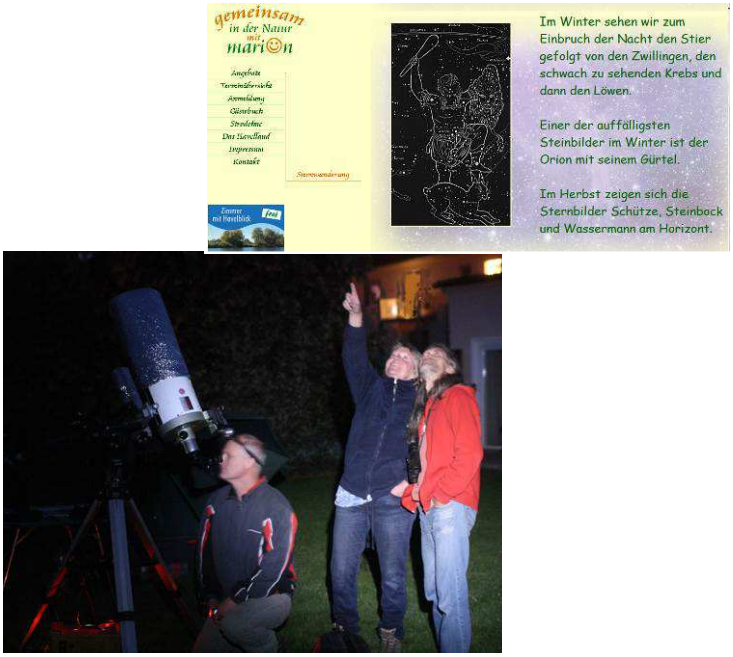
The star parties will continue to be offered in future years, e.g. on the last weekend in August 2014. They will be an important opportunity to:

- offer a high quality dark sky to amateur astronomers of the region and nationwide,
- review the sky quality of the star park by critical reviewers,
- show the local population that the quality of the regional sky is very high and that they will have the possibility to see celestial objects through high quality telescopes,
- be a possibility to attract media interest and political prominent people (see below),
- educate and raise awareness of the general public (non-astronomers).

Fig. 9.8: Some impressions from the star party in 2013 (left photo: *C. Debbe*)

Meanwhile astronomy activities and information on light pollution are an essential part of the activities in the nature park. Several guides (*Martin Miethke* and *Marion Werner*) regularly offer observations of the night sky and the nighttime environment, which attract people even from Berlin. *Marion Werner* talks during her guided tours also about star lores.

Fig. 9.9: *Martin Miethke* and *Marion Werner* give a tour to the stars together with a visiting amateur astronomer from Berlin



In 2013, the exhibition of the nature park's visitors' center in Milow was enlarged. On this occasion a star hut has been installed to demonstrate the night sky with an artificial starry sky (with 500 stars projected by fiber optics). The center counts several thousand visitors annually, mainly school children.

Fig.9.10: In 2013 IDA members *Martin Morgan-Taylor (UK)* and *Dr. Dr. Thomas Posch (Austria)* visited the nature park center in Milow (left) with its star hut (right)

On the occasion of the “European Day of Parks” on June 2nd 2013 actions around stars and light pollution were offered by the nature park administration and the rangers of the Naturwacht and attracted many families with children:


Wo man die Nachtigall singen hört

Fig. 9.11: Announcement and press about the “European Day of Parks” 2013

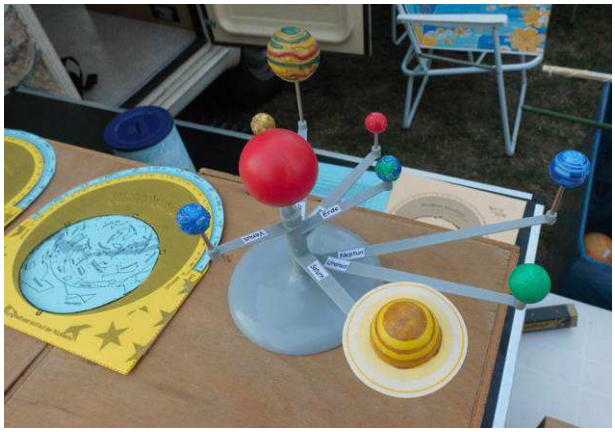


Fig. 9.12: People of the Naturwacht use this model of the solar system to communicate astronomy to children of school classes or during public presentations (Photo: *Debbe*)

Nature Park and Naturwacht participate in several public events in the cities and towns and will present the nature park with all its aspects including the star park.

Public relations and information policy till now is mainly done by the nature park administration and Naturwacht as it is their main task. It can be expected that with the recognition as International Dark Sky Reserve the engagement of the villages will increase. It is planned to distribute information leaflets, to inform on their internet presentations and by informing the public in the framework of exhibitions (which exists and is available) and booths. One first example is the case of the town of Strodehne, which presents the proposed star park on its internet presentation.

Fig. 9.13: Internet presentation of the town Strodehne, mentioning the star park.

Association “Kunst und Kultur” (Art and Culture)

This association has been founded in Gülpe by the owners of the Kreativ-Oase, a guesthouse and center for creative arts. One aim of this association is to support the star park activities. In 2013 the municipality of Rhinow donated two Zeiss telescopes to the association that will be used for astronomical observations. Further on, places for recreational vehicles shall be installed that observers can stay at this dark place.

Fig. 9.14: The municipality of Rhinow donated two Zeiss telescopes to the association “Kunst und Kultur” in Gülpe

Donation of the Zenkart Telescope

The planetarium of Potsdam donates a Celestron C8 telescope to the nature park. It was financed by the inheritance from late *Arnold Zenkert*, who was teacher, for a long time director of the planetarium Potsdam and a famous sun clock researcher. It will be used for the star viewing in the nature park.

Visit of minister and state secretary support the creation of a star park

Märkische Oderzeitung

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11.08.2011 06:13 UHR - AKTUALISIERT 11.08.2011 06:13 UHR

Umweltministerin Anita Tack besuchte Naturpark Westhavelland

Milow . Milow (rez) – Im nördlichen Teil des Naturparks Westhavelland wird es nachts zappenduster. Deshalb eignet sich der sehr dünn besiedelte Landstrich in der Nähe des Gülper Sees bestens für einen Sternenpark.

Zu Gast im Milower Apothekergarten: Ministerin Anita Tack (li.) ließ sich am Donnerstag durch Anker-Apothekerin Beatrix Schlegel durch die Welt der Heilpflanzen führen.

© WERNITZ

The interest and support of the nature park and the aim to become a Dark Sky reserve at higher levels is documented in the visits by the state minister and state secretaries.

The continuous interest of the state government was also demonstrated in 2013, when *Almuth Hartwig-Tiedt*, State Secretary Ministry of Environment, Health and Consumer Protection of Brandenburg participated in the star party and also observed during the night as her husband is amateur astronomer.

Fig. 9.15: The minister of Environment, Health and Consumer Protection of Brandenburg, *Anita Tack*, visited the nature park in August 2011 and was impressed by the idea of creating a dark sky area, because she still studied astronomy in school, as it was a subject which was common in the German Democratic Republic.

Information Leaflet

An information leaflet has been created and printed with information about the nature park, guidelines on how to reduce light pollution and where one can find observing places.

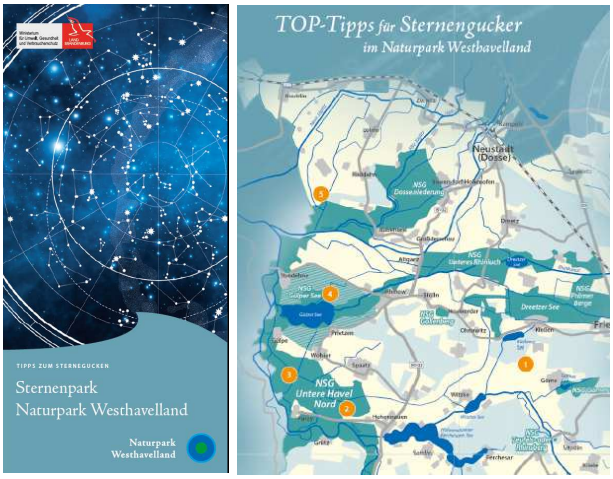

Fig. 9:16: An information leaflet about the star park Westhavelland with a map with recommended observing places

Tourism

The project of the star park is supported by the regional tourism organizations though they can't market it yet as long it has no recognition. However, several guesthouses are marketing already the exceptional night sky of the nature park to increase the number of their visitors:

Kreativ-Oase, Gülpe: offers information material about stars and good lighting and help to organize each year the star party in Gülpe. Their garden can be used to set up telescopes and they have installed a telescope.

Zimmer Marion Werner, Strohdehne: *Marion Werner* offers guided tours under the stars and talks about star lores.

Ferienhaus Milow, Milow: Ferienwohnung Am Haveldeich, Strohdehne

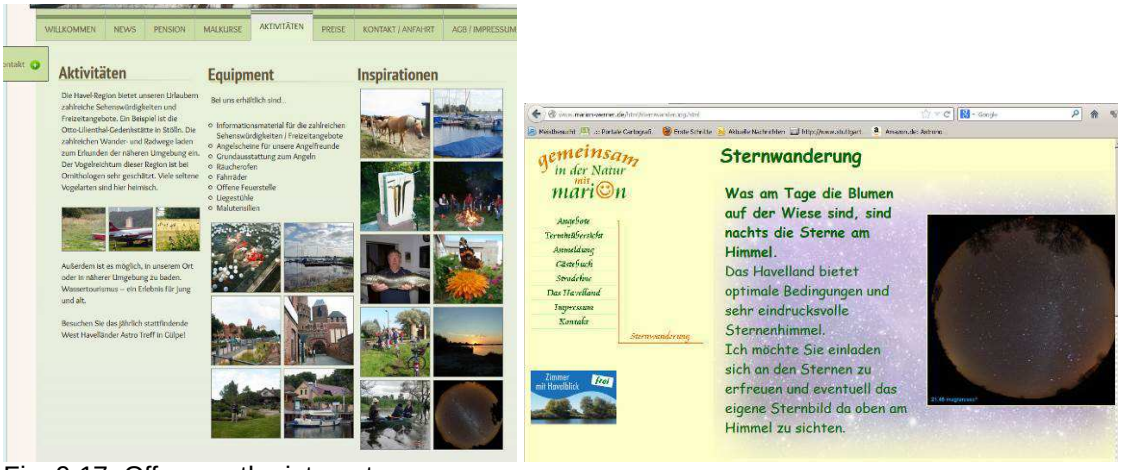

Fig. 9.17: Offers on the internet

Further Plans
A discussion started if and how the star park could become part of the Federal Horticulture Show (Bundesgartenschau) 2015, which will attract tourists from all over Germany. A successful application could help to realize these plans.

10 Research

The proposed dark sky area had already been studied in various projects of different research institutes. This also shows the scientific interest in the project of developing a star park.

As has already been mentioned, a Unihedron SQM-LE has been installed on the roof of the nature park administration building for continuous brightness monitoring with the help *of Chris Kyba* from the "Verlust der Nacht" research project.

A close cooperation with different research departments of the University of Sustainable Development Eberswalde (HNEE) resulted in bachelor and master thesis, of which *Hannah Weickelt's* bachelor thesis was already mentioned. *Sophie Kossack* finalized her master thesis "Development of success factors for the touristic use of star parks" in 2013 at the department of sustainable tourism management (supervisors *Prof. Dr. Hartmut Rein*, and *Dr. Andreas Hänel*).

Fig. 10.1: Bachelor thesis by *Hanna Weickelt* and the master thesis by Sophie Kossack

Josiane Meier from the Department of Urban and Regional Planning (ISR) at the Technische Universität Berlin, studied the political process of designating Dark Sky Areas in the framework of the "Verlust der Nacht" research project (presented at the conference "The bright Side of Night" in June 2013 in Berlin-Erkner, to be published in the conference proceedings). As of October 2013, she will also be leading a study project in which students of urban and regional planning will analyze potentials for the development of ecotourism in the star park.

Andreas Hänel from the German Dark Sky Group studied the practice of public lighting in the potential German star parks Westhavelland and Rhön and presented the results in a poster on „Practice of public lighting in proposed German Star Parks" at the same conference (to be published).

In the framework of the research project "Verlust der Nacht" (Loss of the Night), studies on the influence of artificial light on water insects are being conducted in the Nature Park. In order to conduct the studies artificial lighting is installed for a limited time in a small area near Lochow. The results will help to judge the influence of artificial lighting on the fauna in dark surroundings.

Fig. 10.2: The experimental setup of the research project "Verlust der Nacht" to study the influence of artificial lighting on aquatic insects.

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12 Appendix

Appendix (separate file)

A 1 Sky Brightness Measurements in the Nature Park Westhavelland
A 1.1. Summary of the measurements
A 1.2. Detailed report about the conditions (in German)
A 1.3. Detailed report about the observations in 2013

A 2 Lighting Inventory
A 2.1 Making a lighting inventory
A 2.2 Summary

A 3 Lighting Guidelines
A 3.1 Decisions to support a “Star Park”
A 3.2 Proposals for the decisions in the municipal councils (in German and English)
A 3.3 Explanations to these decisions (in German)
A 3.4 List of examples of full cut-off luminaires available on the German market (public and private)

A 4 Media Coverage

Downloads

F. Czeski, C. Hesse: Leuchtenkataster für den Naturpark Westhavelland, Naturpark Westhavelland
http://www.home.uni-osnabrueck.de/ahaenel/darksky/westhavelland/Lighting_inventory.pdf

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Detailed report about the conditions (in German)
http://www.home.uni-osnabrueck.de/ahaenel/darksky/westhavelland/studie whl_2012.pdf

Detailed report about the observations in 2013
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